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Abdel Latife H. M. Othman
2013 Al Shohada Central Hospital, abdellatif_hassan@med.menofia.edu.eg

Alaa M. Gomaa
Menoufia University

Ibrahim A. S. Elnasr
Menoufia University

Tarek M. Sayyed
Menoufia University

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A normal pattern of uterine involution using symphysis-fundal distance

Abdel Latife H.M. Othman[a], Tarek M. Sayyed[b], Alaa M. Gomaa[b], Ibrahim A.S. Elnasr[b]

[a]2013 Al Shohada Central Hospital, [b]Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Menoufia, Egypt

Correspondence to Abdel Latife H.M. Othman, MBBCh, El Sohadaa, Menoufia, Egypt
Zip code: 32841;
Fax: 0482702786;
Tel: +20 101 065 8836;
e-mail: abdellatif_hassan@med.menofia.edu.eg

Background
Uterine involution is normally completed 6–8 weeks after giving birth. Despite the high variability in uterine involution from one to another parturient, indigent uterine involution has been found to be related to maternal illness.

Objective
The purpose of this study was to estimate the pattern of uterine involution through the use of symphysis-fundal distance (S-FD) to describe the normal pattern of uterine involution in terms of S-FD measurements.

Patients and methods
This was a prospective observational study conducted on 80 term primigravidae, who attended the labor ward of the Obstetrics and Gynecology Department at Al Shohada Central Hospital and followed up weekly after their delivery at the outpatient clinic of the same hospital.

Results
It has been shown that 2 weeks after delivery is the first time that S-FD becomes zero. S-FD becomes zero in the second week in 53 (66.3%) women. Results indicated that in those 3 weeks after delivery, complete involution of the uterus into the pelvis has happened in all cases. The involution rate per day ranged from 0.85 to 1.50 cm, with a mean ± SD of 1.12 ± 0.20 cm.

Conclusion
The upper limit of S-FD immediately after labor was 22 cm. In the first week, it was 15 cm and 6 cm in the second week postpartum. Three weeks after delivery, the entire involution of the uterus into the pelvis has occurred in all cases (S-FD = 0 cm). Different S-FD of initial uterine involution did not lead to different duration for destined involution.

Keywords:
delivery, involution, postpartum, symphysis-fundal distance normal pattern, uterus

Introduction

During the whole pregnancy period, the uterus undergoes an amazing journey from inside the pelvic cavity upward to the abdominal cavity. After delivery, the uterus returns home. This repatriation is called involution of the uterus [1]. Measuring the abdominal distance in centimeters from the symphysis pubis toward the palpable most upper part of the uterus is known as the 'symphysis-fundal distance' or S-FD. Although it is a simple screening tool, it is not a universal approach. S-FD measured in this way is found to be relevant to theses obtained by ultrasonography [2].

During pregnancy, particularly the third trimester, the fetus that did not gain his/her potential growth could be detected by serial measurement of S-FD despite the parity [3]. It was well known that uterine diameters differed in multiparous women from nulliparous ones; therefore, we considered only primigravidae in our study.

When the uterus fails to get back to its nonpregnant position in the pelvic cavity, it is called subinvolution of the uterus, which has many causes, such as metritis, postpartum hemorrhage (PPH), and retained placenta [4]. Because the former causes are life-threatening complications that put the mother's life at an inevitable risk, in-time diagnosis is unquestionable [5]. In the last 15 years, retained placentas accounted for 0.23% of all deliveries, with 26 (36.61%) of these women arriving in a state of severe shock. Thirty-six (50.7%) women needed general anesthesia for manual removal, and one (1.40%) lady underwent hysterectomy due to an attached placenta. The maternal mortality rate was 5.6% [6].

As regards metritis, the infected uterus and cervix got involuted at a slower rate than the noninfected group (45.6 vs. 31.1 days) [7].

Currently, knowing the normal behavior of the uterus in the early postpartum period is essential, especially when the postnatal services differ among countries, this study will be conducted to screen the pattern of uterine involution in terms of S-FD measurements as a simple screening tool in a local society with low resource settings.

Patients and methods

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at Al Shohada Central Hospital from July 1, 2020 to May 30, 2021. All recruited women had been provided an informed written consent.

Our study included primigravidae (18–38 years), term delivery (37–42 weeks), single pregnancy, living in the city, attended the labor ward of Al Shohada Central Hospital, delivered vaginally a healthy newborn that she nursed and breastfed.

Women who had lost their babies, those with infected uteruses, preterm delivery (<37 weeks), and those who delivered abdominally were excluded from our study.

Ethical consideration

The study protocol was revised and approved by the ethics research committee at the Faculty of Medicine at Menoufia University.

The study included 80 term primigravidae who met the inclusion criteria. They were subjected to full history taking and physical examination to rule out any medical or surgical illness that could affect the study. A measuring tape was used to calculate the S-FD and was expressed in cm. At the labor ward, immediately after complete delivery of the placenta and bimanual examination of the pelvis to exclude any apparent uterine masses, we placed the zero mark of the measure tape at the symphysis and let the rest of the tape run along the abdomen to reach the uterine fundus to record the first S-FD. This measurement had been placed on the participant's specific data entry sheet. At the outpatient clinic of Al Shohada Central Hospital, we followed each parturient weekly, and S-FD was measured by the same observer, the same manner that had been used immediately after labor, and the data was also recorded in the participant's specific data entry sheet. During the weekly measurements of S-FD, we asked each woman to empty her bladder if she had not done so in the last 30 min. Each was in a supine position with her thighs slightly flexed during the measurement. During the weekly measurement, we identified the uterine fundus by moving the hand

down below the xiphisternum until the curved upper border of the fundus is felt. During the measurement, the participants were not allowed to breastfeed. Every week, the degree of newborn nursing was recorded as (no, partial, or full). The data had been collected weekly for each participant and recorded on specific data entry sheet to be kept finally 'electronically' in an Excel sheet.

Primary outcome

The primary outcome of this study was to describe the normal pattern of uterine involution in terms of S-FD measurement.

Secondary outcome

Evaluate a relationship between uterine involution rate and maternal age, BMI, neonatal weight, gestational age at labor, prelabor hemoglobin (Hb), oxytocin use, degree of breastfeeding, different S-FD of the same participant, postpartum complications such as PPH, puerperal sepsis, and neonatal admission to NICU.

Statistical analysis

All data were collected, tabulated, and statistically analyzed using the SPSS statistical package, version 22 (SPSS Inc., Chicago, Illinois, USA). A t test was used to compare between two dependent groups of normally distributed variables. The χ^2 test and Fisher's exact were used to calculate the difference between qualitative variables. All statistical comparisons were two-tailed, with a P value of 0.05 denoting a significant difference, P value 0.001 denoting a highly significant difference, and P value more than 0.05 denoting a nonsignificant difference.

Results

Flow chart of the participants included in the study. There were 20 women who were excluded either due to the presence of our exclusion criteria or loss of follow-up (Fig. 1).

Out of the 80 women in the study group with regard to the age, 37 (46.3%) of them were less than 20 years, while 27 (33.8%) women were between 20 and 24 years, nine (11.3%) women were between 25 and 29 years of age, and only seven (8.8%) women were more than 30 years. The age of women ranged from 18 to 33 years with a mean age ± SD being 21.81 ± 3.88 years (Table 1).

Oxytocin was used in 49 (61.3%) women. Atonic PPH was found and controlled in five (6.25%) women.

Figure 1
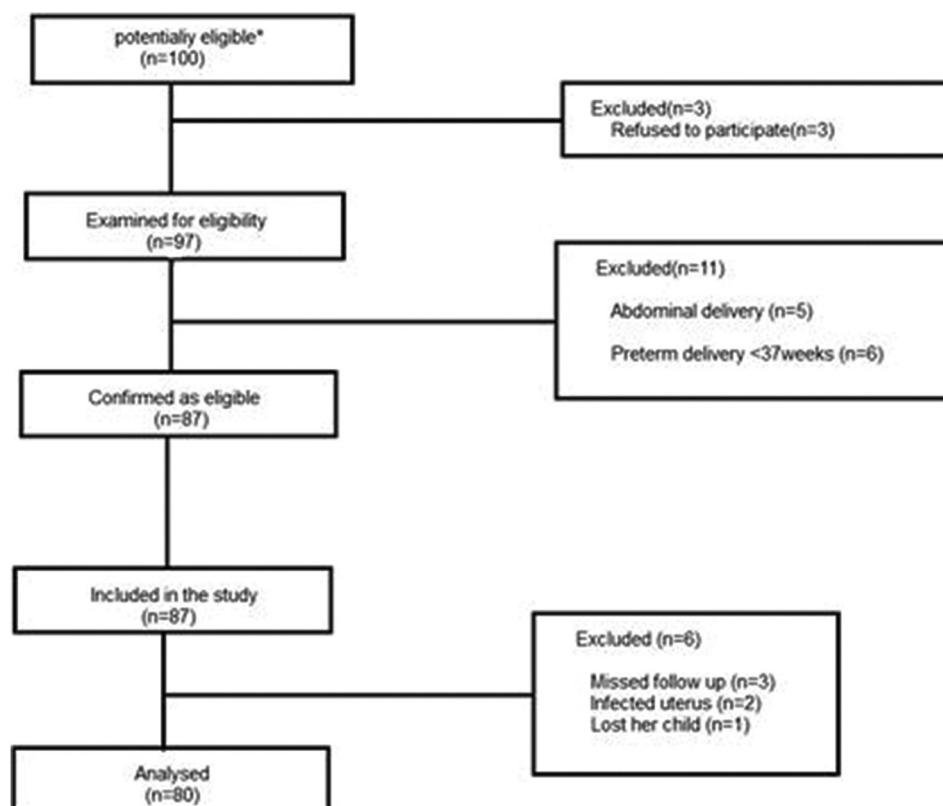
Flow chart of the participants included in the study.

Table 1 Demographic and clinical characteristics in the study group

Parameters	Study group (n=80) [n (%)]
Age (years)	
Mean±SD	21.81±3.88
Range	18-33
≤20	37 (46.3)
20-24	27 (33.8)
25-29	9 (11.3)
≥30	7 (8.8)
Height (cm)	
Mean±SD	163.16±3.96
Weight (kg)	
Mean±SD	75.09±4.29
BMI (kg/m²)	
Mean±SD	28.05±1.09
Prelabor Hb (g/l)	
Median (IQR)	106 (103.25-110)
Range	98-120
Educational level	
Illiterate	8 (10.0)
Moderate	69 (86.3)
High	3 (3.8)

Hb, hemoglobin; IQR, interquartile range. Illiterate: a woman who had never completed her preparatory school. Moderate: a woman who had a technical secondary school. High: a woman who had a university education.

Neonatal weight was ranged from 2500 to 4500 g with mean ± SD of 3170.63 ± 399.3 g.

Distribution of S-FD among the study participants immediately after delivery ranged from 13 to 22 cm and the mean ± SD of 18.20 ± 2.9 (Table 2).

Results showed that 2 weeks after delivery is the first time that S-FD becomes zero and S-FD becomes zero in the second week in 53 (66.3%) women. Results indicated that at 3 weeks after delivery entire involution of the uterus into the pelvic cavity has happened in all cases (Table 3).

The involution rate per day ranged from 0.85 to 1.50 cm with mean ± SD of 1.12 ± 0.20 cm (Table 4).

Overall survival was measured from the date of measurement of S-FD immediately after delivery until S-FD becomes zero. The overall survival of all studied patients was measured and had a mean of 20.198 days. The Kaplan–Meier plot demonstrated that there was 33.75% failures of S-FD to become zero at the second week (Table 5).

Discussion

Uterine involution normally completed within 6–8 weeks after giving birth, despite the high variability in uterine involution from one to another parturient. Indigent uterine involution has been

found to be related to maternal illness especially obstetric hemorrhage, maternal anemia, and endometritis [8].

The aim of this study was to evaluate the pattern of uterine involution through the use of S-FD to describe the normal pattern of uterine involution in terms of S-FD measurements.

This was an observational study conducted on 80 term primigravidae who attended a labor ward of Obstetrics and Gynecology Department at Al Shohada Central Hospital and followed up weekly after their delivery at the outpatient clinic of the same hospital.

In our study, out of the 80 women in the study group with regard to age, 37 (46.3%) of them were less than

20 years, while 27 (33.8%) women were between 20 and 24 years, nine (11.3%) women were between 25 and 29 years of age, and only seven (8.8%) women were more than 30 years. The age of women ranged from 18 to 33 years with the mean age ± SD being 21.81 ± 3.88 years.

In a similar study by Tosun Güleroğlu *et al.* [9], 47 (62.7%) of the total participants were in the age group of 19–27 years and 28 (37.3%) were in the age group of 12–16 years. Mean age was 24.2 years. Also in Hadianti and Sriwenda [10], age group less than 20 years were only three (6%), most of the respondent's age is 20–35 years, as many as 39 (78.0%), and eight (16%) were aged more than 35 years.

Oxytocin was used in 49 (61.3%) women. Neonatal weight ranged from 2500 to 4500 g with mean ± SD of 3170.63 ± 399.3 g.

Along with our results Hadianti and Sriwenda [10] used oxytocin in 25 (50%) of the participants. They reported that neonatal weight mean was 3093.80 g with a median of 3095 g.

In our study atonic PPH was found and controlled in five (6.25%) women. This is slightly more than other studies as that of Almutairi *et al.* [11], which reported that incidences of atonic PPH were 2.5%.

Mean gestational age at labor was 38.61 weeks, which is similar to the Hadianti and Sriwenda [10] study as the reported gestational age was 38.86 weeks.

As regards laboratory findings, the mean Hb value was 10.7 g/dl, it is slightly decreased from many studies as the Dashtinejad *et al.* [12] study, which reported that Hb mean was about 12.5 g/dl.

Previous studies illustrated that the S-FD measurements had been taken by two methods (finger method and tape method); the tape method had expressed a little bit accuracy than the finger method [13].

It is important especially in low-income countries to adapt preventive measures that help in early management of possible obstetric complications (PPH, uterine infection), so the early detection of uterine subinvolution is the main step in prohibiting theses life-threatening problems.

Table 2 Distance between fundus and symphysis pubis immediately after delivery in the study group

Parameters	Study group (*n*=80) [*n* (%)]
13 cm	12 (15.0)
14 cm	1 (1.3)
15 cm	4 (5.0)
16 cm	3 (3.8)
17 cm	6 (7.5)
18 cm	10 (12.5)
19 cm	13 (16.3)
20 cm	14 (17.5)
21 cm	5 (6.3)
22 cm	12 (15.0)
Mean±SD	18.20±2.9
Centiles (5th-90th)	13.0-21.0
Range	13-22

Table 3 Distance between fundus and symphysis pubis 2 weeks after delivery in the study group

Parameters	Study group (*n*=80) [*n* (%)]
0 cm	53 (66.25)
4 cm	3 (3.75)
5 cm	13 (16.25)
6 cm	11 (13.75)
Mean±SD	1.79±2.55
Centiles (5th-90th)	1.0-6.0
Range	0.0-6.0

Table 4 Involution rate per day in the study group

Parameters	Study group (*n*=80) [*n* (%)]
Involution rate per day (cm)	
Mean±SD	1.12±0.20
Range	0.85-1.50

Table 5 Survival analysis in the studied women

Means and medians for survival time							
Mean				Median			
Estimate	SE	95% confidence interval		Estimate	SE	95% confidence interval	
		Lower bound	Upper bound			Lower bound	Upper bound
20.198	0.246	19.716	20.680	21.000	0.070	20.863	21.137

Distribution of S-FD among the study participants immediately after delivery ranged from 13 to 22 cm with a mean ± SD of 18.20 ± 2.9. The distance between the fundus and the symphysis pubis 1 week after delivery ranged from 7 to 15 cm with a mean ± SD of 11.45 ± 2.26.

In keeping with our findings Rianti *et al.* [14] reported that immediately after the delivery value ranged from 12 to 17 cm with a mean of 14.81 cm. Also, Tosun Güleroğlu *et al.* [9] reported a mean ± SD value of 14.5 ± 0.4 cm after delivery. However, Rianti *et al.* [14] reported that fundus height after 1 week reached 3.94 cm.

The decrease in S-FD per day (cm) ranged from 0.85 to 1.5 cm/day with a mean ± SD of 1.12 ± 0.20 in contrast to the recommendation of the WHO indicating independently of the day a mean involution (difference of S-FD) of 2 cm. Along with our results, Rianti *et al.* [14] reported that the involution rate mean reached 1 cm per day in the first 10 days after delivery. Also, the first case noticed to reach a fundus height of 0 cm, which was noticed in the tenth day if no intervention was introduced and fifth day with oxytocin.

As regards factors that affect the uterine involution rate we found no relation between uterine involution rate and maternal age, BMI, age, oxytocin use, controlled atonic PPH, and degree of breastfeeding, which is in agreement with Wataganara *et al.* [15], who found no relation between uterine involution rate and breastfeeding.

In contrast to our findings only an earlier study by Frei *et al.* [13] found that the maternal age, which is a variable determinant in S-FD measured by tape, the fundus is lower (mean difference 0.5 cm immediately after delivery) and the involution is faster in a 20-year-(30-year-) old than in a 30-year-(40-year, respectively) old woman irrespective of the delivery mode.

In general, the results of this study was in accordance with other studies that had measured the S-FD after labor until it became zero (the uterus not palpable abdominally), but our study differed in taking the S-FD immediately after labor after clinical confirmation that no placental parts were missed inside and the uterus was free from apparent fibroids.

As aforementioned, knowing the normal pattern of uterine involution in term of S-FD would alarm the abnormalities of uterine subinvolution as a risk of uterine infection and obstetric hemorrhage, which in turn helps in early management of such life-threatening complications especially in low setting resources. Also, proper treatment of any causes that lower maternal Hb

should be kept in mind as is its relevance to uterine involution rate.

Many proceeding studies recommended against measurement of S-FD postnatal as mere uterine size does not matter in the absence of signs of infection and excessive vaginal bleeding, but this study aimed to describe its normal pattern of involution in terms of S-FD to forecast its delinquency and then prevent the possible complication. Finally, it could not be concluded that S-FD can be measured for the prediction of ongoing uterine subinvolution from single or twice S-FD measurement, so further studies using ultrasound and Doppler uterine indices are advocated.

Conclusion

The upper limit of S-FD immediately after labor was 22 cm. In the first week, it was 15 cm and at 6 cm in the second week postpartum. Three weeks after delivery, complete involution of the uterus into the pelvis has happened in all cases (S-FD = 0 cm). Different S-FD of initial uterine involution did not lead to different durations for destined involution.

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Conflicts of interest
There are no conflicts of interest.

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