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Modified Naegele's Rule for Determination of the Expected Date of Delivery Irrespective of the Cycle Length

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Abstract

The present study included a total number of 750 pregnant females, 300 cases were studied retrospectively and 450 cases were studied prospectively. Different clinical parameters were assessed in relation to the determination of the duration of pregnancy. The length of the menstrual cycle had been the most significant parameter in relation to the duration of pregnancy. In using Naegele's rule we suggest that the menstrual history should be taken in proper consideration though we advise a correction value to the classic Naegele's rule to overcome the error found in the actual day of deliveries.

Introduction

RELIABLE knowledge of the duration of pregnancy prior to birth is often of crucial importance in making obstetric care decision. Traditionally the duration of pregnancy was estimated clinically from the date of the last menstrual period, time of quickening, the first audible fetal heart beats and fundal height [1]. Nowadays the use of ultrasonography in determination of gestational age is progressively increasing. Meanwhile, the physician must always be on guard to avoid expensive procedures.

Benison [2] stated that it became traditional to calculate the expected date of confinement (EDC) from Naegele's rule: Add

7 days to the first day of the last menstrual period, subtract 3 months and add one year (EDC-LMP + 7 days - 3 months + 1 year), this rule is based upon an ideal 28 days cycle, with ovulation occurring on the day 14 of the cycle; however not all women have 28 day cycles, for this reason their EDC cannot be accurately estimated by Naegele's rule [3].

For this reason, we agree with Dommise [4], that the time has come to replace or to modify the traditional Naegele's rule.

The aim of the study was to assess and evaluate prospectively and retrospectively the accuracy and the importance of Naegele's rule and other clinical methods used

in the determination of the gestational age and the duration of pregnancy.

Material and Methods

This study included a total number of 750 cases 300 cases were studied retrospectively and 450 cases were studied prospectively.

Accurate data were recorded about the date of the last menstrual period of the patient, actual delivery date, her age, parity, menstrual history, the biparietal diameter and gestational age by ultrasonography were also taken in some cases, the birth weight was also registered.

Many cases were excluded from the study due to unreliable date of the LMP, patients with premature or induced labour, also pill users and cases with birth weight less than 2800 gm were not included in the study. The pregnancy duration by Naegele's rule was calculated to be compared with the actual duration of pregnancy from the first day of LMP to the date of actual delivery. The difference between both durations was calculated in every case.

In the prospective cases the history, general and obstetric examination were carried out, cases with medical disorder in pregnancy were excluded.

Measurement of the fundal height was done in the prospective cases, with the patient on her back using a metric tape made of non elastic material, the fundal height was measured in centimeters from the upper border of the symphysis pubis to the superior fundus uteri.

The girth of the abdomen has also been measured with the tape passing transversely at the level of the umbilicus.

The mode of delivery was documented

in every case and after birth the infant weight was recorded.

The age of the cases in this study ranged from 15 to 44 years old, 60.4% of them were between 20-29 years old, the number of primiparas were 327 (43.6%) and that of multiparas were 423 (56.4%).

The length of the menstrual cycle was recorded from 715 cases, 72.4% of them had a length of 25-29 days, the duration of flow ranged from 2-7 days, with 78, 15% of them had a duration of flow from 3 to 5 days.

The presentations found in the studied patients were cephalic in 725 cases (96.7%), breech in 17 cases 2.3% and twins in 8 cases (1.07%).

651 (86.8%) cases were delivered vaginally while 99 cases were delivered by selective CS.

The birth weight of the newborn ranged from 3-4.4 kg, 57.25% of the delivered infant had a weight of 3 to 3.4 kg.

The data of the study were analyzed in the computer using a state view programme Brain power inc, (1986).

Pipkin (1984) was the statistical reference used to explain the statistical findings (results).

Results

Table (1) shows the relation of the studied parameters to the difference between the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule and also to the actual duration of pregnancy.

Significant relations were found with the following parameters: Length of the menstrual cycle, duration of menstrual cy-

cle, birth weight in kgs, abdominal girth and symphysis pubis to fundus.

Meanwhile, the relation to the age and parity were statistically non significant.

Table (2) shows the simple correlation between certain parameters and

- 1- The difference between the actual duration of pregnancy and duration calculated by Naegele's rule.
- 2- The actual duration of pregnancy.

In this simple correlations take place between one parameter and the difference or the duration of pregnancy to the other parameters were ignored.

Simple correlation measures the strength of relations between two measures assessed as numbers (in quantities).

Significant correlations were found with the following parameters:

Length of menstrual cycle, duration of menses, birth weight in Kgs abdominal girth and symphysis to fundus whereas, the relation to the age and parity were non significant.

Table (3) shows multiple correlation between certain parameters and the following:

- 1- The difference between the actual duration of pregnancy and the duration of pregnancy calculated by Naegele's rule.
- 2- The actual duration of pregnancy.

In this multiple correlation while we were correlating one parameter to the difference or the actual duration of pregnancy the others were considered and respected.

Cases included in this multiple correlation were 191 cases. The most important factor affecting the duration of pregnancy

was the length of menstrual cycle.

Significant correlations were found with length of menstrual cycle, duration of menses and birth weight in Kgs. And non significant with age, parity, abdominal girth and symphysis to fundus.

Table (4) shows the duration of pregnancy as determined by Naegele's rule and as determined from the date of delivery and the possible correction value for Naegele's rule.

Thus, the difference between the actual and Naegele's duration of pregnancy varied from 40 to 43 days with mean 2.25 ± 11.6 , this difference was statistical significance.

Table (5) illustrates the difference recorded between expected delivery date as determined by Naegele's rule and actual date of delivery cases delivered at the same EDD = 43 cases (5.73%).

Fig. (1) shows a histogram for the difference recorded in table 5. It is a distribution of cases delivered before and after the EDD in weeks, it appeared to show a normal distribution i.e with the concentration of cases around the expected date, this histogram roughly evaluated Naegele's rule as a good method for gestational age assessment, from the statistical point of view most of the cases delivered around and near to the expected date of delivery.

Fig. (2) shows the relation between the difference in the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule as well as the length of menstrual cycle in days.

Horizontal line = Naegele's duration of pregnancy.

Slope line = actual duration of pregnancy. We noticed that most of the cycles lie

between 28-30 days and the range of the length of menstrual cycle was 21-35 days.

Fig. (3) shows the relation between the difference in the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule as well as fetal birth weight in Kgs.

Horizontal line = Naegele's duration of pregnancy.

Slope line = actual duration of pregnancy. We notice that most of fetal birth

weights lie between 3-3.5 Kg.

Fig. (4) illustrates the relation between the difference in the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule as well as symphysis to fundus distance in cm (S-F).

Horizontal line = Naegele's duration of pregnancy.

Slope line = actual duration of pregnancy. The S-F distances lie between 27-45 cms. Cases concentrated between 30-38 cms.

Table (1): Relation of Certain Parameters to:

- 1- The Difference between the Actual Duration of Pregnancy and Duration of Pregnancy Calculated by Naegele's Rule.
- 2- Actual Duration of Pregnancy.

Parameter	No. of cases	Mean	Range	S.D	S.E	Diff. bet. actual and Naegele's duration		Actual duration of pregnancy	
						<i>p</i>	Sig	<i>p</i>	Sig
Age of mother in years	750	26.18	15:46	5.6	0.20	0.3601	N.S	0.3545	N.S
Parity	750	2.32	1:11	1.73	0.06	0.2660	N.S	0.3267	N.S
Length of mens. cycle	715	27.95	21:35	1.93	0.07	0.0001	S	0.0001	S
Duration of mens. cycle	714	4.64	2:10	1.34	0.05	0.0282	S	0.0247	S
Birth weight in kgs.	545	3.30	2.8:4.9	0.41	0.02	0.0001	S	0.0001	S
Abdominal girth	193	102.86	82:136	9.15	0.66	0.0173	S	0.0231	S
Symph. to xiph.	194	41.05	33:59	3.56	0.27	0.0146	S	0.0302	S
Symph. to fundus	194	34.99	27:45	2.97	0.21	0.0096	S	0.0097	S

N.S = Non significant.

S = Significant.

Table (2): Simple Correlation between Certain Parameters and:

- 1- The Difference between the Actual Duration of Pregnancy and Duration Calculated by Naegele's Rule.
- 2- The Actual Duration of Pregnancy.

Parameter	Diff. between actual and Naegele's duration		Actual duration of pregnancy	
	Correlation Coef.	Significance	Correlation Coef.	Significance
Age	0.033	N.S	0.034	N.S
Parity	0.041	N.S	0.036	N.S
Length of menstr. cycle	0.177	S	0.171	S
Duration of menstr. flow	0.082	S	0.084	S
Birth wt.	0.170	S	0.168	S
Abdominal girth	0.171	S	0.164	S
Symph. to xiph.	0.175	S	0.156	S
Symph. to fundus	0.186	S	0.185	S

Table (3): Multiple Correlation between Certain Parameters and:

- 1- The Difference between the Actual Duration of Pregnancy and the Duration of Pregnancy Calculated by Naegele's Rule
- 2- The Actual Duration of Pregnancy.

Parameter	Diff. between actual and Naegele's duration		Actual duration of pregnancy	
	<i>p</i>	Significance	<i>p</i>	Significance
Age	0.1773	N.S	0.1773	N.S
Parity	0.4154	N.S	0.4154	N.S
Length of menstr. cycle	0.0003	S	0.0003	S
Duration of menstr. cycle	0.0027	S	0.0426	S
Birth wt.	0.0001	S	0.0001	S
Abdominal girth	0.6559	N.S	0.6559	N.S
Symph. to xiph.	0.4080	N.S	0.408	N.S
Symph. to fundus	0.7144	N.S	0.7144	N.S

Table (4): Multiple Correlation between Certain Parameters and:

- 1- The Difference between the Actual Duration of Pregnancy and the Duration of Pregnancy Calculated by naegele's Rule
- 2- The Actual Duration of Pregnancy.

	Duration of pregnancy as calculated by Naegele's rule	Actual duration of pregnancy	Difference between actual and Naegele's duration of pregnancy
Mean S.D	280.83 ± 0.83	278.54 ± 11.52	- 2.28 ± 11.57
Rnge	280 - 283	240 - 232	- 40 - 43
S.E	0.03	0.42	0.42
<i>t</i>		5.405	
<i>p</i>		< 0.0001	

The difference is significant.

Table (5): Difference Recorded between Expected Delivery Date as Determined by Naegele's Rule and Actual Date Delivery.

Delivered before EDD			Delivered after EDD		
Difference in days	No. of cases	%	Difference in days	No. of cases	%
1 Week	201	26.80	1 Week	165	22.00
2 Weeks	112	14.93	2 Weeks	95	12.67
3 Weeks	53	7.07	3 Weeks	18	2.40
4 Weeks	26	3.47	4 Weeks	9	1.20
5 Weeks	14	1.87	5 Weeks	5	0.67
6 Weeks	6	.80	6 Weeks	2	0.27
			7 Weeks	1	0.13

Cases delivered at the same EDD = 43 cases (5.73 %)

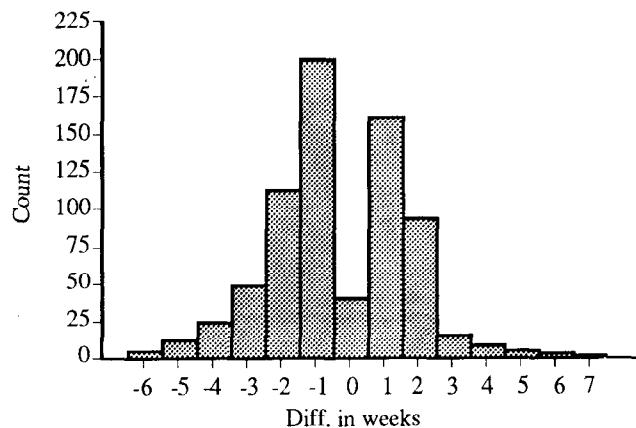


Fig. (1): Histogram showing the difference recorded in table (5).

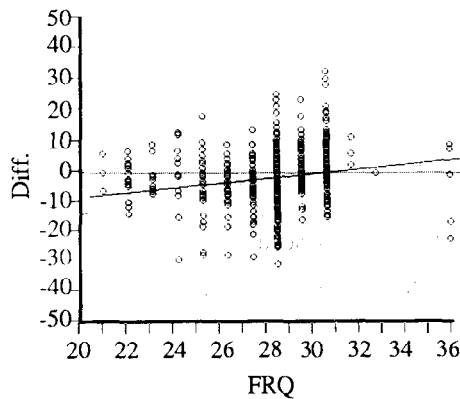


Fig. (2): Relation between the difference between the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule and the length of menstrual cycle in days (FRQ).
 - Horizontal line = Naegele's duration of pregnancy.
 - Slope line = actual duration of pregnancy.
 * Most of the cycles lie between 28-30 days.
 * The range of the length of menstrual cycle is 21-35 days.

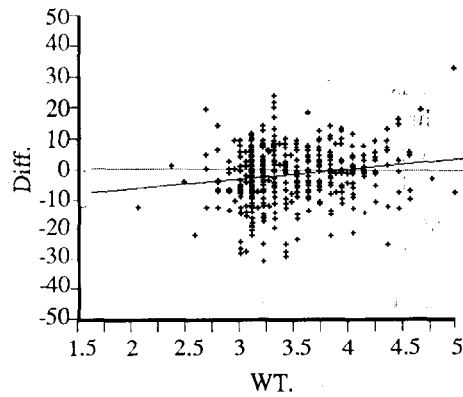


Fig. (3): Relation between the difference between the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule and birth weight in Kgs. (WT).
 - Horizontal line = Naegele's duration of pregnancy.
 - Slope line = actual duration of pregnancy.
 * Most of birth weights lies between 3-3.5 Kgs.

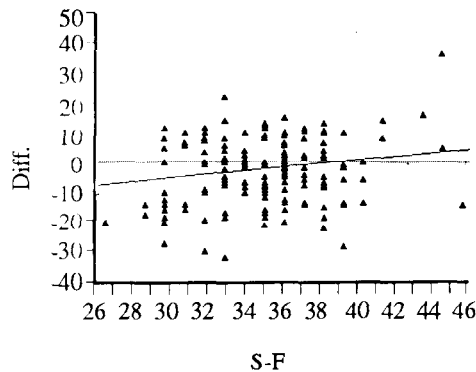


Fig. (4): Relation between the difference between the actual duration of pregnancy and duration of pregnancy calculated by Naegele's rule and symphysis to fundus distance in cm. (S-F).
 - Horizontal line = Naegele's duration of pregnancy.
 - Slope line = actual duration of pregnancy.
 * The S-F distance lies between 27-45 cm.
 * Cases were concentrated between 30-38 cm.

Discussion

Naegele's rule is still the only mathematical method used to determine EDD. However, the main disadvantage of this method is the fallacy determined in the calculation of the EDD in cycle longer or shorter than 28 days. Accordingly, the calculation of the expected date of delivery is arbitrary in cases having cycles other than 28 days [5]. To the best of our knowledge no attempt was done to correct this defect, since Naegele's introduce his rule in obstetric practice in 1829 [4].

In the present study, the accuracy of the Naegele's rule in the determination of the EDD was found to be only 5.73% for the whole random samples studied (with 28 days cycle), this finding agrees with the previous results which was 4% [2].

The defects in calculation of the EDD by Naegele's rule is related to the fact that it is based on a 28 days cycle, with expect-

tation that ovulation occurs on the fourteenth day of the cycle and conception occurs usually around the day of ovulation (± 48 hrs) in 95% of the cases [6]. Moreover, the discrepancies caused by 31 day-months and the 29 day variation in February of leap years are not correctable by Naegele's rule [1].

Accordingly, increase or decrease in the length of the cycle will give a false shortening or lengthening of the conception delivery interval, as the variability mostly affects the follicular phase of the cycle, a correct date for delivery may be obtained by Naegele's rule, if the increase or decrease in this follicular phase is considered properly [2]. In other words, short cycle needs to subtracting of correction factor and vice versa.

The suggestive modified Naegele's rule should be: the first day of LMP + 7 days + 9 months \pm correction value i.e. adding or subtracting the number of days exceeding or receding from the classic 28 days cycle.

The suggested modified rule was proved to be accurate in determining the EDD in all cases irrespective of the length of the cycle. No statistically significant difference was detected between calculation recorded by this modified rule and the actual date of delivery.

In the same way, no significant differences were detected between the calculated date of delivery by the modified rule and BW, abdominal girth and fundal height.

The disadvantage of Naegele's rule and modified rule is still in the sharp determination of the first day of menstrual cycle. Accordingly, other mathematical and metric methods for the determination of the EDD is usually needed, in this study measurement of the abdominal girth, fundal

height were found very helpful and significantly correlate with that date determined by this rule.

In the present study, the length of gestation was 287.5 days and the mean birth weight was 3.3 kgs. These findings match with those of Secher et al. [7].

The fundal height in the studied cases was found to be 34.99 ± 2.97 cm, this was comparable to the study of Person et al. [8,9] who found it 36.1 ± 3.7 cm at 40 weeks gestation. Meanwhile, Baily et al. [10], found that the fundal height measurement showed a wide variation in its performance, the sensitivity of the method ranging from 27 to 86%.

Whereas, in this study the age of the mother and the parity were found to be non significant in determining the duration of pregnancy, this finding was in accordance with Donald et al. [11], who found that the increase parity among the grand multipara was not associated with significant variation in the length of gestation, while Papiernik [12], found that preterm birth rate was higher in multipara.

Concerning the parameters which we have taken into consideration to correlate with the pregnancy duration, whatever the actual or the difference we could classify them as: CAUSE and RESULT i.e. age of the mother in years, parity, length of the menstrual cycle and duration of the menstrual flow, are considered as causes. Whereas, the factors resulting from the length of pregnant duration are: weight of the baby, abdominal girth and symphysis to fundus distance.

The present study revealed that Naegele's rule can still be used in determination of the expected date of deliveries. However, we suggest that a correction val-

ue must be considered to reduce error found in its applications.

The menstrual history particularly the length was found to be the most important and significant item affecting the duration of pregnancy in our study.

References

- 1- CHAMBERLAIN, G.: A re-examination of antenatal care. *Obstet. Gynecol. Surg.*, 35:85, 1980.
- 2- BENSON, R. C.: *Handbook of Obstetrics and Gynecology* 7th Ed., Libraire du Liban, Beirut, p. 78, 1980.
- 3- BENSON, R.C.: *Current Obstetric and Gynecology, Diagnosis and Treatment*. Lange Medical Publication, Los Altos, California, p. 541, 1984.
- 4- DOMMISSE, J.: Gestation age -fact or fallacy? *South African Medical Journal*, 58: 449, 1980.
- 5- HOTELLING, H. and HOTELLING, F.: A new analysis of duration of pregnancy data. *Am. J. Obstet. Gynecol.*, 23: 643, 1932.
- 6- WAHLL, F.A.: Are children larger and does pregnancy lasts longer than formely? *Dutsch Med. Wchnshr*, 63: 769, 1937.
- 7- SECHER, N.J.; HANSEN, P.K.; LENSTRUP, C. et al.: Birth weight for gestational age charts based on early ultrasound estimation of gestational age. *Brit. J. Obstet. Gynecol.*, 93: 128, 1986.
- 8- PERSSON, B.; STANGANBERG, M.; LUNELL, N.O. et al.: Prediction of size of infant at birth by measurements of symphysis fundus height. *Brit. J. Obstet. Gynecol.*, 93: 206, 1986.
- 9- AZIZ, R.; SMITH, S. and FABRO, S.: The development and use of a standard symphysis fundal height growth curve in the prediction of small for gestational age neonates. *Int. J. Gynecol. Obstet.*, 26: 81, 1987.
- 10- BAILY, S. M.; SARMANDAL, P. and GRANT, J.M.: A comparison of three methods of assessing interobserve variation to measurement of the symphysis fundal height. *Brit. J. Obstet and Gynecol.*, 96: 1266, 1989.
- 11- DONALD: *The grand multipara. I, practical Obstet. Problems*. 5th Ed. Looud Luke Ltd. London, 1979.
- 12- PAPIERNIK, E.: Prediction of the preterm baby. In P.W. Howie and N.B. Patel, *Clinic in Obstetrics and Gynecology*, Vol. 11, No. 2., W.B. Saunders Company, London.