GRAPHICAL PRESENTATION OF CERVICAL DILATATION ASSESSMENTS DURING LABOUR

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Abstract: Results of cervical dilatation assessments during labour are usually plotted vs. time on graph forms, which are named partograms or cervigrams. Their appearance is rather uniform although they are designed by different institutions. They are used for monitoring the progress of labour, for determination of the rate of cervical dilatation and to aid obstetricians in deciding upon interventions. Characteristics of partographs avalable from papers on that subject were explored. General rules for plotting data were applied for the design of the cervigram form. Characteristics of the majority of avalable partograms were as follows: dilatation scale smallest division was 1cm, time scale smallest division was 1h and 1cm/h dilatation rate line inclination was less then 45°. Optimal characteristics of partograms according to the general rules for plotting data are: dilatation scale smallest division 2cm, time scale smallest division 5min and 1cm/h dilatation rate line inclination 45°. Result of adherence to the general rules for plotting data is cervigram form somewhat different from cervigram forms published earlier. Scale divisions are in predefined relations to the accuracy of measurements so better portrayal of labor is enabled.

Introduction

Partograms[1] are used for monitoring the progress of labor. Since the initiation of their use some thirty years ago [1] their elements and appearance were not significantly modified. Although almost every institution which uses partograms designs its own partogram, there are no substantial differences in these designs.

Cervigrams – graphs of cervical dilatation vs. time – are essential part of every partogram. General remarks concerning partograms could be repeated for their central part – the cervigram.

The question whether cervigrams in use represent optimal solutions was not systematically explored, although some elements were investigated [2,3].

There are generally two approaches in finding answer to this question. The first is experimental and the second theoretical in a way.

In the first approach one element of cervigram is variable (either simulated data or real data are used) and the effects it institutes on the outcome, management and the course of labor are evaluated. Cartmill et al. [2] compared cervigrams with different inclination of the dilatation line for the same rate (1cm/h) of dilatation. They were denoted as steep and shallow format. Angle of inclination was 45° for steep format and for shallow format inclination was 21° and 27°. When obstetricians were asked about their actions based on the data presented on cervigrams, steep formats were associated with fewer interventions and shallow formats with increased tendency to intervene (caesarean section, augmentation of labor). Similar results were obtained in another study [3]. These results were the basis for recommendation that steep formats (45° inclination) are preferable (formats steeper then 45° were not investigated).

Some influence of cervigrams on obstetrical decision making was indirectly stated by Barret et al. [4]. Results of their study showed that obstetricians are not consistent in decision making upon interventions when the same data are presented to them after certain period. Since partograms (specifications of partograms were not given) were part of the data presented their ambiguities possibly influenced obstetricians inconsistencies.

Results of these studies indicate that presentation of data on partograms influences decisions obstetricians make in the course of labor.

Besides, in the period since partograms were introduced into obstetrical practice, attempts were made to determine the error of cervical dilatation assessment [5,6]. The error of cervical dilatation assessment was estimated on models. The results presented in both studies were almost equal. The assessment of the cervical dilatation is accurate within ±1cm in approximately 90% of assessments. The accuracy in the situation when one examiner performs repeated assessments and in the situation when different examiners are assessing the same dilatation is almost unchanged. Error in cervical dilatation assessment may influence decisions obstetricians make in the course of labor [7].

[1] Terms partogram, partograph and cervigram are used almost as synonyms because they were used in that way in previous studies.

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The second approach to determine optimal form of cervigram is to apply well established general rules for plotting data to draw cervigrams. In this case it is supposed that cervigrams are not different from any other graph and that adherence to these rules will give the best results.

In this work the second approach was used in establishing optimal characteristics of cervigrams. Primary intention was to make graphic portrayal of labor as accurate as possible without changes in the process of obtaining data.

Materials and Methods

Three most important components of cervigrams were identified and their characteristics in accordance with the general rules for plotting data defined [8,9,10]. These components are: cervical dilatation scale, time scale and inclination of the 1cm/h cervical dilatation rate line. General rules of graphing, which might have little influence on named components are not specified. The rules which have significant influence on named components are as follows:

* the choice of scales should be made in such a way that it bears some relation to the accuracy with which the plotted data are known,

* the smallest divisions on scales ought to be larger than the error of the plotted data or error of measurement ought to be drawn as error bar in some points, at least,

* inclination of the line or mayor part of the curve ought to be at approximately 45° angle to x axis.

Following these rules optimal form of cervigram is proposed.

Components of cervigrams published earlier were investigated regarding characteristics of these components.

Results

The cervigram form drawn in accordance with the general rules for plotting data looks like the one in Figure 1.

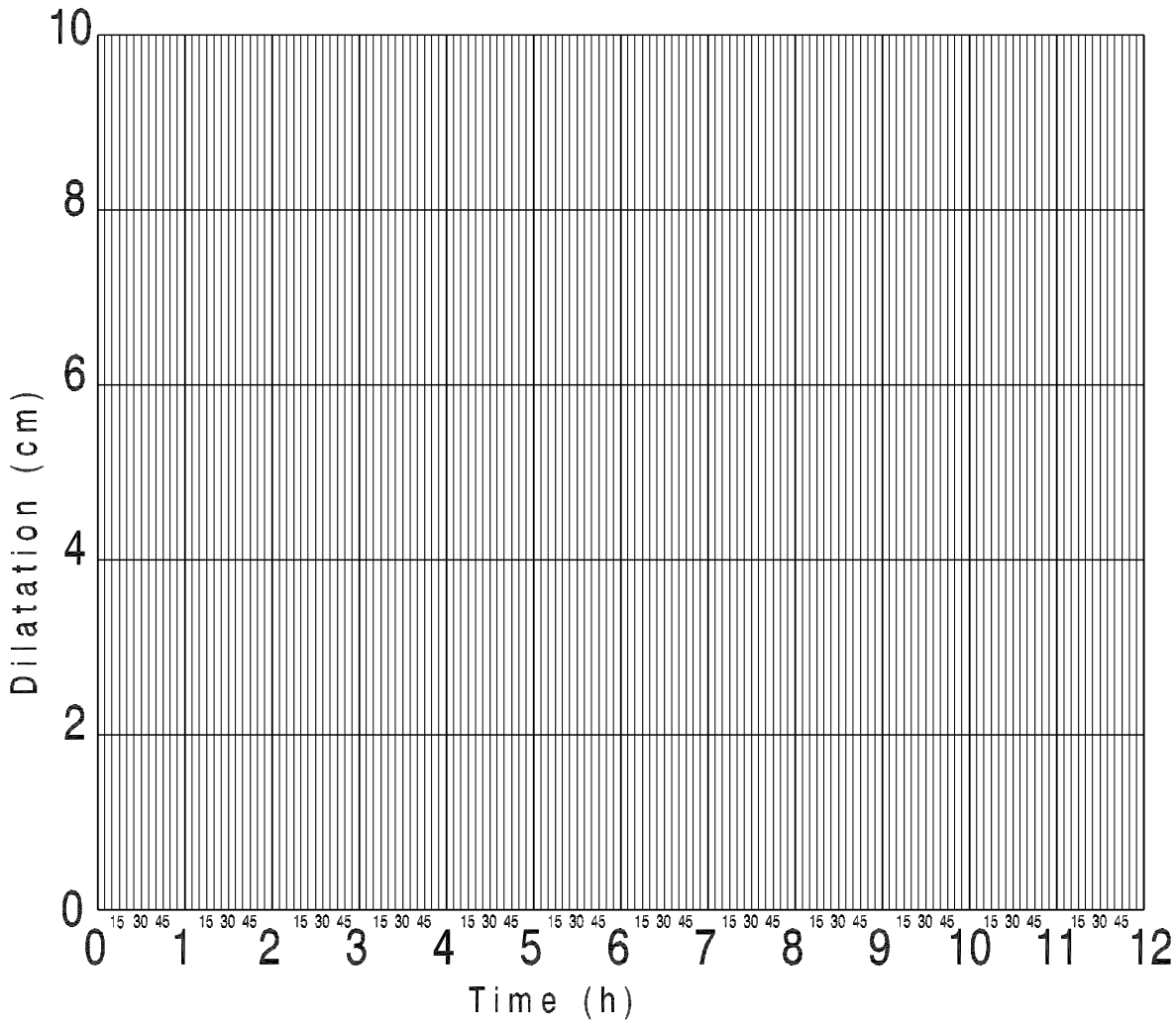

Figure 1: Cervigram form in accordance with the rules for plotting data

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Table 1 shows characteristics of cervigrams, namely smallest divisions of the cervical dilatation scale and of the time scale and inclination of the 1cm/h rate of dilatation line.

Table 1: Characteristics of cervigrams published earlier

Cervigram No.	Smallest division on dilatation scale (cm)	time scale (h)	Inclination (°)
1 [1]	1	1	43
2 [11]	1	1	45
3 [12]	1	1	32
4 [13]	1	1	59
5 [14]	1	1	45
6 [15]	1	1	17
7 [16]	1	1	27
8 [17]	1	1	30
9 [18]	1	0.5	27
10 [19]	1	0.25	17
11 [20]	1	1	36
12 [21]	1	1	37

Discussion

Cervical dilatation is expressed in centimeters. Sometimes the smallest increment in dilatation which is being expressed is 5mm or half of a centimeter [5]. In the case when something is measured with the instrument with the analog scale the smallest unit on the scale is the smallest unit that can be measured and it would also be the smallest unit on the scale of the graph if measured values are being plotted. If the error in measurement is half of the smallest unit [22], such instrument is characterized as proper instrument [10]. Cervical dilatation is assessed manually. So, the smallest unit that can be assessed is arbitrary. However, it does not have different values on various partograms and it is always 1cm. With the error of assessment known to be ±1cm the smallest unit is not entirely arbitrary anymore. Using the analogy with instruments with the analog scale the smallest value that can be measured with certainty is 2cm. Consequentially the smallest division on the cervical dilatation scale on the graph ought to be 2cm. Error in measurement of 1cm is implied in such a scale.

Labor lasts several hours. The time when assessment of cervical dilatation is made can be determined very precisely. This precision can be much higher than it is actually needed for the monitoring of the progress of labor. To determine accuracy in time measurement needed for progress of labor monitoring, interval between two manual assessments (usually two hours and not more than four hours) has to be taken into account. Error in determining that interval should not be more than 5% and there is probably no need to be less than 1%.Manual examination and assessment last a few minutes and 2% of the interval between two examinations is also few minutes (2-3 minutes). If it is taken into account that all possible units smaller than one hour are not equally applicable as the smallest units of time that are measured and as the smallest divisions on time scale, then 5min, 10min, 15min and 30min intervals seam to be most appropriate. Error of 2.5min and the smallest time unit to be measured of 5min offer the highest accuracy and they don′t require extra effort, activity or tools to be attained. Error in determining two hour interval is in this case approximately 4%. The smallest unit on time scale is 5min and implied error 2.5min.

Dilatation rate of 1cm/h is the value which discriminates normal from slow rates of dilatation. Rules for graphing suggest for 1cm/h line to be at 45° inclination at x axis (time scale). This actually confirms conclusions of the studies described earlier [2,3] which favored steep partograms (45° inclination).

Consistent adherence to the rules for graphing produced cervigram design shown in Figure 1, which differs from cervigram forms published earlier.

The smallest division on cervical dilatation scale is 1 cm on every cervigram in Table 1. However, before the magnitude of cervical dilatation started to be expressed in centimeters, many local scales existed. They were usually five level scales frequently based on the width of a finger (approximately 2cm) as the smallest unit [23,24,25]. Although change from local scales to metric scale was not associated with higher accuracy of assessments, change in the number of possible levels of cervical dilatation implied higher accuracy of assessments. Significance of this fact is stressed by the circumstance that it is not usual to draw error bars on cervigrams.

Time scales in Table 1 are divided in 1h units and on one partogram in 15min units. Fifteen minutes divisions on the time scale indicate that more precise temporal information was sought. One hour time units seem to be unnecessary symmetry with one centimeter units on dilatation scale. This reduces quality of information conveyed with the partogram and it is accentuated by the fact that partograms are not accompanied by tables which could perhaps offer more accurate data.

Five minutes intervals in Figure 1 are small enough to enable precise plotting of time coordinate and large enough to enable easy measurement. Larger units on time scales now in use will enable precise time coordinate plotting just if usual two hourly rhythm in manual examinations is strictly observed, which is not common practice and very often not possible.

Scale divisions as in Figure 1 are in predefined relation to the accuracy of measurements, so partograms drawn with their use represent progress of labor with higher fidelity then partograms with usual scales. Partograms currently in use would have to be plotted with error bars for both, dilatation and time, in order to accomplish the same quality of information as partograms with cervigram form as in Figure 1.

Inclination of the 1cm/h dilatation rate line at 45° to time axis is optimal from the standpoint of general rules for graphing. The same conclusion was made after

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experimental studies [2,3]. There is no reason for that angle to be different than 45°. On published partograms this angle is very often smaller than 45°, sometimes even smaller than 20°. One study of partograms in clinical use found that this angle was almost always between 20° and 30° [26].

Conclusions

Proposed cervigram form is different from cervigram forms currently in use. Error in cervical dilatation assessment and error in time at which this assessment is made are defined and implied in cervigram scales. In this way data plotting on such cervigram forms portrays labour consistently without unnecessary ambiguities. Furthermore it clearly indicates that further improvement in the progress of labour monitoring can be achieved through higher accuracy in the determination of the cervical dilatation.

References

[1] PHILPOTT R.H. (1972): 'Graphic records in labour', *Br. Med. J.*, **4**, pp. 163-65

[2] CARTMILL R.S.V., THORNTON J.G. (1992): 'Effect of presentation of partogram information on obstetric decision-making', *Lancet*, **339**, pp. 1520-22

[3] TAY S.K., YONG T.T. (1996): 'Visual effect of partogram designs on the management and outcome of labour', *Aust. N. Z. J. Obstet. Gynaecol.*, **36**, pp. 395-400

[4] BARRET J.F.R, JARVIS G.J., MACDONALD H.N., BUCHAN P.C., TYRRELL S.N., LILFORD R.J. (1990): 'Inconsistencies in clinical decisions in obstetrics', *Lancet*, **336**, pp. 549-51

[5] TUFFNELL D.J., JOHNSON N., BRYCE F., LILFORD R.J. (1989): 'Simulation of cervical changes in labour: reproducibility of expert assessment', *Lancet*, **2**, pp. 1089-90

[6] PHELPS J.Y., HIGBY K., SMYTH M.H., WARD J.A., ARREDONDO F., MAYER A.R., (1995): 'Accuracy and intraobserver variability of simulated cervical dilatation measurements', *Am. J. Obstet. Gynecol.*, **173**, pp. 942-5

[7] LETIĆ M. (2003) 'Inaccuracy in cervical dilatation assessment and the progress of labour monitoring', *Med. Hypotheses*, **60** , pp. 199-201

[8] BERNARD C.H., EPP C.D. (1987): 'Laboratory experiments in college physics'. (John Wiley & Sons, New York), pp. 6-9

[9] DIMIĆ G.L., MITRINOVIĆ M.D. (1990): 'Metrology in physics D'. (Građevinska knjiga, Beograd), pp. 68-70

[10] ANIČIN I.V. (1990): 'Evaluation of measurements'. (Univerzitet u Beogradu, Beograd), pp. 51- 55

[11] LEDGER W.J., WITTING W.C. (1972): 'The use of a cervical dilatation graph in the management of primigravidae in labour', *J. Obstet. Gynaecol. Br. Commonw.*, **79**, pp. 710-4

[12] STUDD J. (1973): 'Partograms and nomograms of cervical dilatation in management of primigravid labour', *Br. Med. J.*, **4**, pp. 451-5

[13] BEAZLEY J.M. (1972): 'Use of partograms in labour', *Proc. R. Soc. Med.*, **65**, p. 700

[14] DUJARDIN B., DE SCHAMPHELEIRE I., SENE H., NDIAYE F. (1992): 'Value of the alert and action lines on the partogram', *Lancet*, **339**, pp. 1336-38

[15] BALAS E.A.,PRYOR A., HEBERTSON R.M., HAUG P.J., TWEDE M. (1991): 'A computer method for visual presentation and programmed evaluation of labor'. *Obstet. Gynecol.*, **78**, pp. 419-21

[16] MLADENOVIĆ D., MILOVANOVIĆ V., JOVANOVIĆ R. (1977): 'Partograms and contemporary labor management', *Jugoslav. Ginek. Opstet.*, **17**, pp. 389-94

[17] NOTELOVITZ M. (1973): 'Graphic records in labour', *Br. Med. J.*,**1**, p. 50

[18] SCHWALM H. (1957): 'The partogram', *Geburtsh. Frauenhk.*, **17**, pp. 105-21

[19] WILKEN H., HEINRICH J., STRAUBE W. (1986): 'New aspects of improved labor management', *Zbl. Gynäk.*, **108**, pp. 1-16

[20] LAVENDER T., WALLYMAHMED AH., WALKINSHAW SA. (1999): 'Managing labor using partograms with different action lines: a prospective study of women s views', *Birth*, **26**, pp. 89-96

[21] KHAN K.S., RIZVI A. (1995): 'The partograph in the management of labor following caesarean section', *Int. J. Obstet. Gynecol.*, **50**, pp. 151-157

[22] OLSON, W.H. (1995): ' Concepts of medical instrumentation', in WEBSTER, J.G. (Ed): 'Medical Instrumentation'. (John Wiley & Sons ,New York) p. 22

[23] FRIEDMAN E.A. (1954): 'The graphic analysis of labor'. *Am. J. Obstet. Gynecol.*, **68**, pp. 1568-75

[24] DINULOVIĆ D.S. (Ed) (1996): 'Obstetrics'. (Službeni list, Beograd)

[25] Medical encyclopaedia. II ed. (1967) (Jugoslavenski leksikografski zavod , Zagreb)

[26] LETIĆ M. (2001): 'Partograms use in Serbia and their characteristics', *Srp. Arh. Celok. Lek.*, **129**, pp. 239-42

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