Severity of labour pain: influence of physical as well as psychologic variables

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The role of physical factors in the severity of labour pain has been neglected. The amount of cervical dilation, the frequency of the contractions, the woman's height and usual weight before the pregnancy and other physical factors were therefore examined in relation to the intensity of labour pain in 141 primiparous and 99 multiparous women. In general, pain increased gradually during labour in both groups of women, though the severity of the pain was lower in the women who had received prepared childbirth training than in those who had not. Although the average pain scores in this study were high, there were striking individual differences, some women having extremely severe pain and others having almost none. The pain scores in both groups of women were significantly correlated with the ratios of the women's usual weight to height. In the multiparous women the scores were also correlated with the woman's usual weight and the baby's weight but not with the woman's weight gain during pregnancy. Thus, the results show that physical as well as psychologic factors contribute to the severity of labour pain.

La contribution des facteurs physiques à l'intensité des douleurs de l'accouchement a été négligée. Le degré de dilatation cervicale, la fréquence des contractions, la taille et le poids habituel de la femme avant la grossesse de même que d'autres facteurs physiques ont donc été étudiés en rapport avec l'intensité des douleurs d'accouchement chez 141 femmes primipares et 99 femmes multipares. Règle générale, la douleur augmentait progressivement en intensité au cours du travail chez les deux groupes de femmes, bien que la douleur ait été moins intense chez celles qui avaient suivi des cours de préparation à l'accouchement que chez celles qui n'en avaient pas suivi. Bien que les cotes moyennes de la douleur enregistrées dans cette étude aient été élevées, on constate des différences individuelles marquées: certaines femmes avaient des douleurs très intenses, alors que d'autres n'en avaient presque pas. Chez les deux groupes de femmes les cotes de la douleur ont montré une corrélation significative avec le rapport poids habituel/taille de la femme. Chez les femmes multipares il y avait aussi une corrélation avec le poids habituel de la femme et avec le poids du bébé mais non avec le gain pondéral durant la grossesse. Les résultats de cette étude démontrent donc que des facteurs physiques aussi bien que psychologiques contribuent à l'intensité des douleurs d'accouchement.

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The recent emphasis on the role of psychologic variables in the severity of labour pain, due largely to the development of prepared childbirth training techniques,[1,2] has led to the virtual neglect of the role of physical factors. A previous study showed that primiparous women who received prepared childbirth training had significantly lower labour pain scores than those who did not.[3] However, the differences were relatively small, and most of the women who had received prepared childbirth training still reported high levels of pain and requested epidural anesthesia.

In the same study menstrual problems and socioeconomic status were also found to be important determinants of the severity of labour pain.[3] Primiparous and multiparous women with a history of severe menstrual pain had significantly higher levels of labour pain. In contrast, labour pain was less intense among women with a higher socioeconomic status. Although several other variables were correlated with the severity of labour pain — for example, older women tended to have less painful labour — regression analyses revealed that only prepared childbirth training, menstrual difficulties and socioeconomic status were significant predictors of pain. All three factors were significant predictors in the primiparous women, whereas only the latter two were significant predictors in the multiparous women. These three predictors, however, accounted for a relatively small proportion of the variation in the pain scores.

On the basis of clinical observation, obstetricians[4,5] and anesthesiologists[6,7] have reported that pain increases as a function of increasing frequency of contractions and amount of cervical dilation. Moreover, it is commonly believed that labour pain is influenced by the woman's weight gain during pregnancy.[4] However, none of these variables had been systematically investigated with a valid, reliable pain-measuring instrument such as the McGill Pain Questionnaire.[8,9] We used the questionnaire to determine the relation between physical variables, such as the frequency of contractions and the woman's weight, and perceived pain intensity. We also investigated the spatial distribution of pain and its modification by epidural anesthesia.

Patients and methods

The study group comprised 240 women, ranging in age from 14 to 38 (mean 28) years, in the obstetric unit of the Montreal General Hospital. An experimenter interviewed successive women as each met the study criteria: cervical dilation of at least 2 to 3 cm and contractions at intervals of 5 minutes or less. Since only 5% of the women refused to take part in the study, the

remaining 240 women were a representative sample of women in labour.

After the women consented to take part in the study they were asked to answer the McGill Pain Questionnaire. The questionnaire was completed once by 141 (87 primiparous and 54 multiparous) women and twice or more by 79 (42 primiparous and 37 multiparous) women who were studied for changes in pain intensity during the course of labour and by 20 (12 primiparous and 8 multiparous) women who reported on changes in the spatial distribution of their pain.

One day after delivery the women were asked the questions in the unit's postpartum information form[3] regarding psychologic and social variables considered to be possible determinants of the severity of labour pain. In addition, the women's height, weight and weight gain during pregnancy and the neonates' weight and length were recorded. Some women were reluctant to provide personal information and were not pressed to do so.

The McGill Pain Questionnaire

The McGill Pain Questionnaire (Fig. 1) consists of 20 sets of words describing sensory, affective, evaluative and miscellaneous dimensions of the experience of pain. Recent studies have shown the questionnaire to be reliable, to be sensitive to the effects of different therapies on chronic pain and to discriminate between different pain syndromes, including labour pain.[9]

The questionnaire was given to the women between contractions, the examiner using the following instructions:

This is a questionnaire that allows us to get a measure of the amount of pain you are feeling during contractions. The questionnaire consists of 20 lists of words that describe feelings and sensations. I will read each list, or category, to you. If any of these words describe what you feel, please tell me and I will make a mark at the side of the appropriate word. Choose only one word in each category, the one that best expresses your feeling or sensation. If the words in any category do not describe what you feel, we will leave the category blank.

Two major indexes can be obtained from the questionnaire. The first is the pain rating index (PRI), which is the sum of the rank values of the words chosen, which are based on the positions of the words in each category. The PRI can be computed separately for the sensory (categories 1 to 10), affective (categories 11 to 15), evaluative (category 16) and miscellaneous (categories 17 to 20) words or as a total score for categories 1 to 20. The second is an index of present pain intensity (PPI), a measure of the overall pain intensity on a scale of 0 to 5: 0 represents no, 1 mild, 2 discomforting, 3 distressing, 4 horrible and 5 excruciating pain.

The spatial distribution of pain was recorded by asking the patient to indicate the location of mild, moderate and severe pain on a standard line drawing of the body[6] each time the questionnaire was given.

The time points for each questionnaire score were calculated as the number of hours prior to the time of delivery, which was designated as time zero.

Results

Increase in labour pain as a function of time

The major physical variables in labour pain are the frequency of the contractions and the degree of cervical

McGILL PAIN QUESTIONNAIRE

Patient's Name_____

Date _____ Time _____

1	FLICKERING		
	QUIVERING		
	PULSING		
	THROBBING		
	BEATING		
	POUNDING		
2	JUMPING		
	FLASHING		
	SHOOTING		
3	PRICKING		
	BORING		
	DRILLING		
	STABBING		
	LANCINATING		
4	SHARP		
	CUTTING		
	LACERATING		
5	PINCHING		
	PRESSING		
	GNAWING		
	CRAMPING		
	CRUSHING		
6	TUGGING		
	PULLING		
	WRENCHING		
7	HOT		
	BURNING		
	SCALDING		
	SEARING		
8	TINGLING		
	ITCHY		
	SMARTING		
	STINGING		
9	DULL		
	SORE		
	HURTING		
	ACHING		
	HEAVY		
10	TENDER		
	TAUT		
	RASPING		
	SPLITTING		
		11	TIRING
			EXHAUSTING
		12	SICKENING
			SUFFOCATING
		13	FEARFUL
			FRIGHTFUL
			TERRIFYING
		14	PUNISHING
			GRUELLING
			CRUEL
			VICIOUS
			KILLING
		15	WRETCHED
			BLINDING
		16	ANNOYING
			TROUBLESOME
			MISERABLE
			INTENSE
			UNBEARABLE
		17	SPREADING
			RADIATING
			PENETRATING
			PIERCING
		18	TIGHT
			NUMB
			DRAWING
			SQUEEZING
			TEARING
		19	COOL
			COLD
			FREEZING
		20	NAGGING
			NAUSEATING
			AGONIZING
			DREADFUL
			TORTURING

PPI	
0	No pain
1	MILD
2	DISCOMFORTING
3	DISTRESSING
4	HORRIBLE
5	EXCRUCIATING

FIG. 1—McGill Pain Questionnaire. Categories of pain: sensory, 1 to 10; affective, 11 to 15; evaluative, 16; and miscellaneous, 17 to 20. Rank value for each word based on position of word in category. Sum of rank values = pain rating index (PRI); index of present pain intensity (PPI) based on scale of 0 to 5.

dilation. It is generally assumed that the pain increases as these variables increase. We attributed our failure to find this relation in our earlier study to the small samples of women who were tested at different stages of labour.[3] Therefore, in this study 79 women received successive questionnaires during labour: 24 received two or three questionnaires, and 55 received four or more.

The mean pain scores at each hour up to the time of delivery were recorded for all the women according to whether they had received prepared childbirth training (Fig. 2). In both groups there was a relatively steady increase in pain as labour progressed. The primiparous women had higher levels of pain than the multiparous women, and the women who had received prepared childbirth training had lower levels of pain than those who had not received such training. In general, however, the levels of pain were extremely high in both groups, thus confirming our earlier findings.[3]

Stepwise multiple regression analyses of the data revealed that, for the primiparous women, both the frequency of the contractions and the amount of cervical dilation were statistically significant predictors of pain ($p = 0.01$ for the PRI-evaluative scores, $p = 0.01$ for the PRI-miscellaneous scores, and $p = 0.05$ for the PRI-total scores). For the multiparous women the amount of cervical dilation was a significant predictor ($p = 0.05$) of the PRI-evaluative scores, but the frequency of the contractions did not predict any of the pain indexes. Prepared childbirth training was a significant predictor of pain in both the primiparous women ($p = 0.01$ for the PRI-miscellaneous and PRI-total scores) and the multiparous women ($p = 0.05$ for the PRI-affective and PRI-evaluative scores, and $p = 0.01$ for the PRI-total scores).

Variability of labour pain

The frequency of contractions is known to vary considerably during labour.[5,6] Not as well known is the variability of pain scores. The PRI-total scores for both groups of women according to whether they had received prepared childbirth training are shown in Fig. 3. It is clear that the scores vary from woman to woman and vary with time for each woman. Instead of the "idealized" upward curve that is usually shown in obstetric texts,[5] which reflects the average scores shown in Fig. 2, there is a wide variety of patterns in Fig. 3. While the expected upward curve is shown for some of

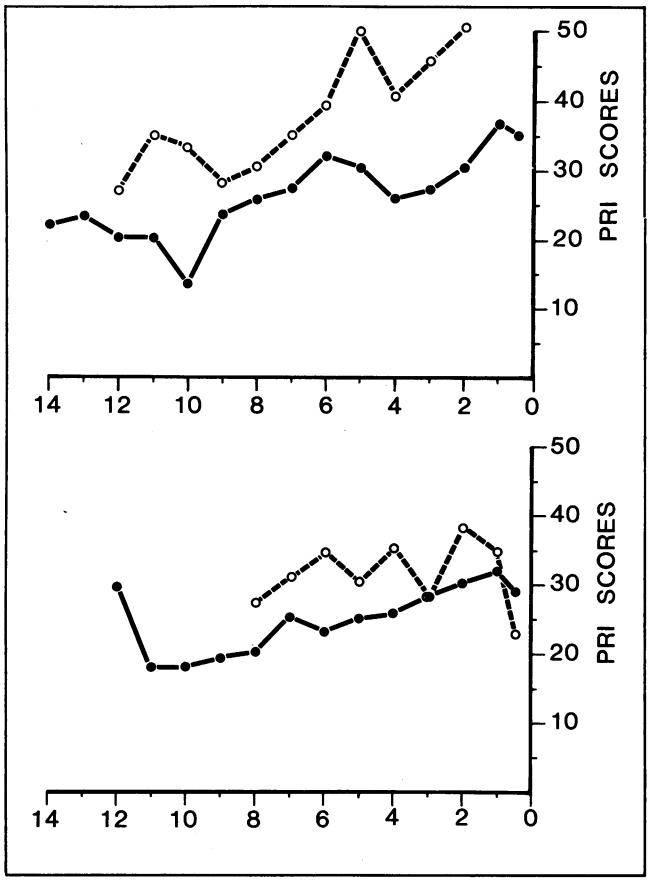

FIG. 2—Average PRI scores reported by primiparous women (top) and multiparous women (bottom) each hour before delivery. Scores, shown separately for women who had received prepared childbirth training (broken lines) and those who had not (solid lines), were assigned to nearest hour for purposes of calculation.

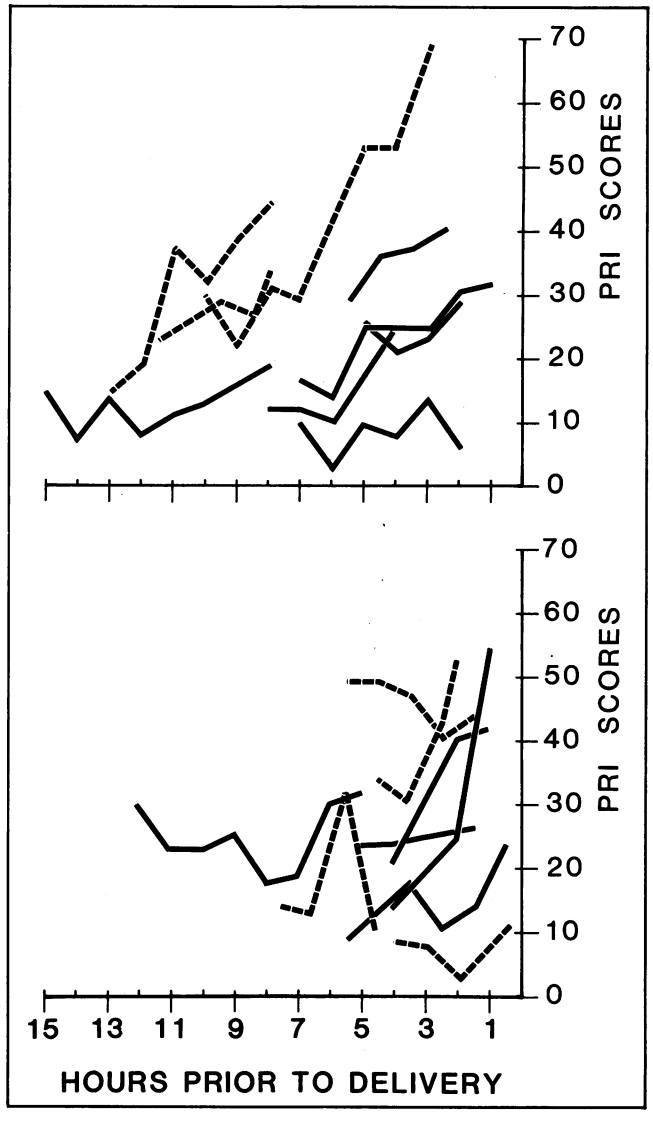

FIG. 3—Individual PRI scores reported by primiparous women (top) and multiparous women (bottom) each hour before delivery. Definitions of lines as in Fig. 2.

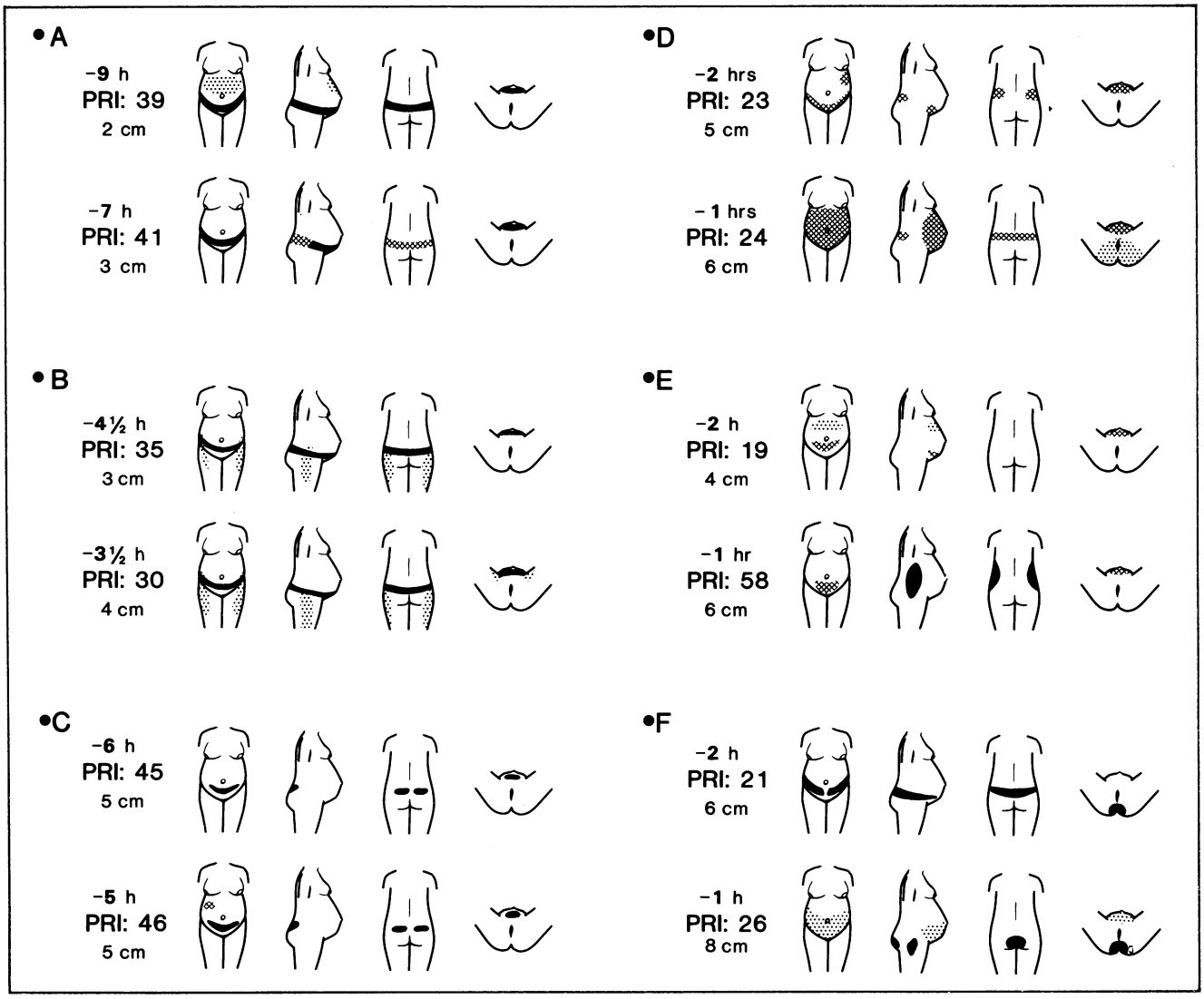

FIG. 4—Spatial distribution of pain in six women (primiparous on left, multiparous on right) at various times before delivery, with PRI scores and amount of cervical dilation. Pain intensity indicated by dots (mild), cross-hatching (moderate) and solid areas (severe).

Table I—Relation between physical variables and pain indexes*

Variable	No. of primiparous women	Level of significance	No. of multiparous women	Level of significance
Mother				
Height	57	NS	41	NS
Usual weight before pregnancy	72	NS	43	PRI-E, r = 0.30 PRI-M, r = 0.43 PRI-T, r = 0.30
Ratio of usual weight to height	57	PRI-S, r = 0.23 PRI-A, r = 0.23 PRI-T, r = 0.27	40	PRI-E, r = 0.27 PRI-M, r = 0.36
Weight gain during pregnancy	60	NS	35	NS
Ratio of weight gain to height	47	NS	35	NS
Baby				
Weight	82	NS	51	PRI-S, r = 0.27 PRI-M, r = 0.24 PRI-T, r = 0.29
Gestational age	74	NS	44	NS

*All correlations shown are significant at $p < 0.05$. NS = not significant; PRI = pain rating index; S = sensory; A = affective; T = total; E = evaluative; M = miscellaneous.

the women, there are upward-and-downward curves for others. Some women had extremely high levels of pain early in labour, whereas others had fairly low, constant pain levels up to the time of delivery. The incomplete curves in Fig. 3 represent the women who refused to continue with the questionnaire because they were too fatigued or wanted epidural anesthesia.

The high level of individual variability is also reflected in the spatial distribution of the pain (Fig. 4). The typical, idealized distributions shown by Bonica[6] may reflect events in a large population taken as a whole, but they hide the striking variability we found among individual women. Some women experienced widespread pain over a large part of the abdomen, the back and the perineum, whereas others had pain in discrete areas.

Menstrual pain and age as predictors of pain

The variables in the regression analyses included many of those described in our earlier study[3] and confirmed their significant correlation with pain. Only the pain scores obtained within the 4 hours before delivery were included in the analyses in this study. Prepared childbirth training was significantly correlated with lower pain scores for both the primiparous women ($p = 0.01$ for the PRI-miscellaneous and PRI-total scores) and the multiparous women ($p = 0.05$ for the PRI-affective and PRI-evaluative scores, and $p = 0.01$ for the PRI-total scores). Furthermore, in both groups of women a history of menstrual difficulties was associated with increased labour pain ($p = 0.05$ for the PRI-sensory scores and $p = 0.01$ for the PRI-miscellaneous and PRI-total scores in the primiparous women, and $p = 0.05$ for the PRI-sensory scores in the multiparous women). In contrast, age was negatively correlated with pain, so that the older women generally had less severe labour pain ($p = 0.05$ for the PRI-sensory scores and $p = 0.01$ for the PRI-total scores in the primiparous women, and $p = 0.05$ for the PRI-affective and PRI-evaluative scores in the multiparous women).

Weight, height and other physical variables

Table I shows the significant ($p < 0.05$) Pearson correlation coefficients for each of the major variables examined. The only variable that significantly contributed to the pain scores of the primiparous women was the ratio of their usual weight before pregnancy to their height — that is, the greater the woman's usual weight per unit of height, the higher the pain scores.

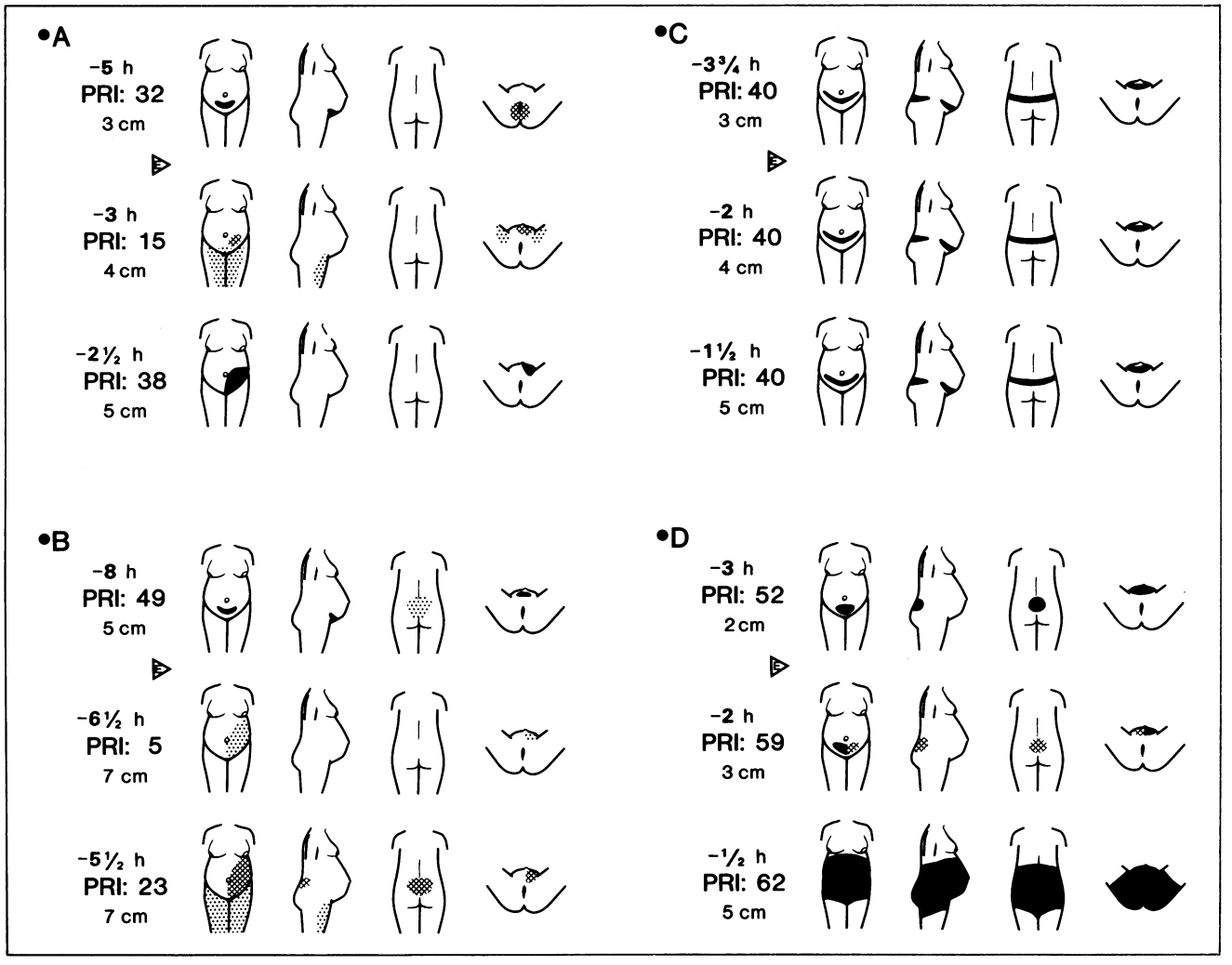

FIG. 5—Spatial distribution of pain in four women before and after ineffective epidural anesthesia (▷). Definitions as in Fig. 4.

The same variable contributed to the pain scores of the multiparous women, but, in addition, the women who weighed more and the women whose babies weighed more also had higher pain scores. Not surprisingly, a woman's usual weight was significantly correlated with her baby's weight ($r = 0.23$; $p = 0.007$). Even more significant was the correlation between a woman's weight at term and her baby's weight ($r = 0.43$; $p < 0.0001$). However, the baby's weight appears to account for only a portion of the increased correlation; the correlation between a woman's weight gain and her baby's weight was only 0.17 ($p = 0.03$). In general, then, women who weigh more tend to have babies who weigh more. However, these relatively low correlation coefficients, though statistically significant, reflect the high degree of variability of all the measures related to labour pain.

The duration of labour was significantly greater ($p < 0.0001$) among the primiparous women (14.4 hours) than among the multiparous women (10 hours). However, none of the pain scores showed a significant correlation with duration of labour.

Effects of epidural anesthesia on pain

The effects of epidural anesthesia on the intensity and spatial distribution of pain were studied in 12 of the women. The anesthesia was ineffective in four of them. The pain scores decreased by an average of 89% in the women in whom the epidural anesthesia was effective but increased by an average of 9% in those in whom it was ineffective. There was no clear-cut relation between the pain intensity and the spatial distribution of pain after either effective or ineffective epidural anesthesia. Fig. 5 shows the considerable individual variability and the unpredictable changes in pain distribution due to ineffective anesthesia.

Discussion

The data from our study indicate that physical variables play an important role in the severity of labour pain. The frequency of the contractions and the amount of cervical dilation are significant predictors of several indexes of pain. The significant correlations between the pain scores and the women's and the babies' weights provide even further evidence of the role of physical variables. While these results are not surprising, they need to be stressed to counterbalance the overwhelming emphasis placed on psychologic variables by proponents of prepared childbirth training programs.[1,2]

Our results confirm the effectiveness of prepared childbirth training, which is shown with striking clarity in Fig. 2. However, Fig. 2 also shows that women who have received prepared childbirth training still have high levels of pain. It is therefore evident that both physical and psychologic factors are determinants of the severity of labour pain. Our results emphasize the need for a balanced view so that prospective mothers are made aware of the possibility that physical factors may over-ride their feelings of psychologic "preparedness". Our earlier study showed that a high proportion of women who received prepared childbirth training requested epidural anesthesia to control their pain even when their instructors urged them not to.

The failure rate of epidural anesthesia observed in this study (33%) is unusually high; previous studies found a failure rate of about 10%.[3,6,7] The high rate in this study may have been a chance event due to the small number of women (12) in the sample. However, it was more likely due to the inexperience of the anesthetists, several of whom were just beginning their residency in anesthesiology, and probably does not reflect the general ability of anesthesiologists or the level of success usually achieved.

The most striking result of our study was the variability among the women in the intensity and spatial distribution of pain. In some women this variability was even observed from hour to hour, although in most women the pain increased with time.

Many factors contribute to this variability. Psychologic factors, implicated by the significant effects of prepared childbirth training, are clearly involved. But so are physical factors, including the weight of the woman and the infant. An additional physical factor is the shape of the woman's pelvic brim.[4] All these factors need to be considered if we are to achieve a satisfactory understanding of labour pain and learn the best ways to decrease its severity without adversely affecting the health of the woman and the infant.

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