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Effects of physiotherapy on pain and functional activities after cesarean delivery

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Abstract
Purpose To investigate the effects of a physiotherapy program on incision pain and functional activities in the early post-cesarean period.
Methods Fifty women were evaluated after Cesarean operation with regard to times of ambulation and return of bowel activity, intensity of incision pain, difficulty in functional activities and number of analgesics required additional to routine pain control procedure. Twenty-four women received only routine nursing care, and a physiotherapy program was applied to the study group ($n = 26$), additionally.
Results Postoperative ambulation and return of bowel activity were earlier in the study group ($p < 0.05$). Incision pain and difficulty in functional activities decreased significantly within 2 days in both groups, and the values were lower in the study group ($p < 0.05$). Study group needed less medication for pain control ($p < 0.05$).
Conclusions Findings revealed the effectiveness of a physiotherapy program in the early post-cesarean period in a wider perspective than the current literature, and are considered to be valuable for increasing the quality and productivity of the postnatal care, therefore improving well-being after childbirth.

Keywords Connective tissue manipulation · Obstetric rehabilitation · Physical therapy · Postnatal exercise · Transcutaneous electrical nerve stimulation

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Introduction

Post-cesarean health problems such as incisional pain, intestinal problems, mastitis, depression, nausea, vomiting and anxiety are issues which have been studied prospectively or retrospectively, by many researchers [1–7].

In the literature, physiotherapy studies in the early post-cesarean period usually consider the use and effectiveness of transcutaneous electrical nerve stimulation (TENS) on incision pain and the amount of narcotics used for that pain [2–6]. Smith et al. [6] stated that TENS was more effective than placebo TENS in reducing cutaneous, movement-associated post-cesarean incision pain, but not effective in reducing analgesic intake. Reynolds et al. [4] also suggested that TENS caused no reduction in narcotic requirements following cesarean section. Navarro Nuñez and Pacheo Carrasco [3] investigated the effectiveness of TENS in comparison with intravenous administration of 1 g of dipyrone on post-cesarean pain, and pointed out that TENS was an effective alternative method in reducing the pain in the early post-cesarean period.

Additionally, there are some studies which investigated the effectiveness of TENS on hypotension after spinal

anesthesia, nausea and vomiting after cesarean section [8, 9]. There is only one study, which presents the results of respiratory physiotherapy on pulmonary functions of women following cesarean delivery under general anesthesia [10].

Therapeutic acupressure is another non-pharmacological method used for reducing anxiety, pain perception, nausea and vomiting after cesarean deliveries [1, 11–15].

As mentioned above, subject-related literature is grossly limited with TENS, and there is lack of information about the use and effectiveness of physiotherapy applications in the early post-cesarean period. To test the hypotheses that physiotherapy facilitates the recovery in the early post-cesarean period, this study was planned to investigate the effects of physiotherapy applications on post-cesarean ambulation time, return of bowel activity, incision pain, need of analgesics and difficulty during functional activities, and therefore, to provide a wider perspective of obstetrical physiotherapy applications to the related literature.

Materials and methods

Women who underwent cesarean delivery under general anesthesia due to obstetric indications (repeat cesarean delivery, pelvic abnormalities that preclude engagement, malpresentation of the fetus, dystocia and elective cesarean) at a University Hospital in Ankara, between December 2004 and May 2005 were involved in this study. The study sample consisted of women who were followed and operated by the same obstetrician (SB). Exclusion criteria for the study were; having multiple births, deliveries with operative complications, cesarean sections with spinal or epidural anesthesia, and using patient controlled anesthesia (PCA). All eligible patients were informed and written consents were obtained before the study according to the principles outlined in the Declaration of Helsinki. None of the subjects refused to participate, and 50 women completed the study which was approved by the Institutional Ethical Committee and registered to ClinicalTrials.gov.

In this prospectively designed, controlled and assessor blinded trial, subjects were assigned into study or control groups, according to the date they gave birth (even/odd days). Neither the assessor nor the department staff (including the obstetrician) was aware of the randomization technique. Subjects in the study group ($n = 26$) received physiotherapy applications in the early post-cesarean period, and the control group ($n = 24$) did not receive any applications other than routine nursing care.

Cesarean section technique and routine care of the patients

All subjects were operated by the same obstetrician (SB) and lower segment transverse incision technique was used for the cesarean section. After delivery, patients were transferred to their rooms within the obstetric ward. Vital signs (heart rate, blood pressure and breathing rate) and body temperatures were assessed regularly. Patients were not allowed to feed orally before bowel movements had started. For post-operative pain control in the first 24 h, meperidine (50 mg, 4 × 1) and non-steroid anti-inflammatory medicine (4 × 1) were administered intravenously. If required by the patient, additional analgesics or anti-inflammatory medications were also administered by the nurses, who were blinded to the group assignment. Patients were encouraged for early ambulation after delivery if they were not hypotensive and uterine bleeding was under control. Initially, they ambulated 10–15 m inside their rooms, and the intensity increased in hours and days. Patients were usually discharged within 48–72 h in uncomplicated cases.

Assessments

Age (years), height (m), weight (kg) and body mass index (kg/m^2) values (at the end of pregnancy) were recorded as physical characteristics. Number of pregnancies, parity, abortus, dilatation and curettage (D&C), cesarean section (last one included) and duration of gestation (day) were recorded as obstetrical history.

Subjects were interviewed in relation with their health problems before and during pregnancy in order to determine inter-group differences. Health problems were then classified for statistical analyses as systemic (hypertension, thyroid dysfunction, diabetes mellitus, anti-phospholipids syndrome, factor V Leiden mutation), musculoskeletal (back and low back pain), neurologic problems (headache, disc hernia), urinary incontinence and constipation.

Time from transfer to obstetric department room to first ambulation after cesarean was calculated for statistical analyses. Also the presence of pre-syncopal symptoms during the first ambulation was recorded.

The patients were asked to record time of breaking gas and defecation in order to calculate the time passed since they were transferred to the room.

Intensity of incision pain was evaluated by horizontal 0–10 cm visual analogue scales (VASs), which were reported to be sensitive to pharmacological and non-pharmacological procedures that alter the experience of pain [1]. Patients marked the point best describing the intensity of their pain in resting on VAS (0 = no pain, 10 = unbearable pain).

In order to evaluate the difficulty during functional activities (turning in bed, coming into sitting/standing positions, and walking) three separate 0–10 cm VASs (0 = no difficulty, 10 = unable to perform the activity) were marked by the patients, and the total score was recorded (0–30 points).

Intensity of incision pain and amount of difficulty in functional activities were evaluated daily before the physiotherapy program in the study group.

Length of staying at the hospital and number of analgesic/anti-inflammatory medication additional to the standard pain control procedure were recorded, and also cases were observed for any adverse effects which may be due to the physiotherapy applications.

Physiotherapy program

Applications for respiratory functions

These applications were included in the physiotherapy program, since they are not among standards of care for post-cesarean patients in our country. Thoracic expansion exercises were included in the program because of their effects on expansion of lungs and complete exchange of gases, elimination of waste products, abdominal muscle tonus, blood circulation, secretions, and relaxation [16, 17]. Also huffing technique—an easier, less painful and more effective method than coughing,—was taught to the subjects [16].

Applications for blood circulation

Bending, stretching and circumflexion of feet at the ankles, leg bracing, knee bending and straightening exercises were included in the physiotherapy program to improve circulation, reduce edema, prevent possible post-operational circulatory problems, hasten recovery from the anesthetics and prepare the patient for the effort required in first getting out of the bed [16].

Thoracic expansion and active lower limb exercises were performed every hour when the patients were awake, with five repetitions in the operation day. After that day, exercises were done with ten repetitions, three times a day.

Applications for incision pain

TENS with frequency of 120 Hz and pulse width of 60 μs was used for 30 min in every session. Self-adhesive electrodes were placed on each side of the incision, and current intensity was increased up to the sensation of strong tingling, without causing contraction and uncomfortable feeling [16, 18, 19].

Applications for intestinal activity

Connective tissue manipulation (CTM) to the sacral and lumbar regions was applied daily, as soon as the subjects could come into sitting position, and lasted approximately 5 min in each session. CTM, in which localized and specific strokes are applied by the third fingertip to make traction between skin and tissues underneath, was included in the program because of its effects on pain and visceral dysfunction (decreased intestinal motility in this study) via stimulating segmental and supra-segmental reflexes [20–22]. Specific strokes used in this study included: strokes to the sacrum, iliac crests, sacroiliac joints, lumbar paravertebral region and subcostal region, as explained by Tappan [22]. Posterior pelvic tilt exercises were also included in the program to contract abdominal muscles, stimulate intestinal activity and prevent or control gas pain [16]. Exercises were performed three times a day, with ten repetitions, within the limits of pain.

Other

In order to retrain postural awareness, improve straight posture and prevent possible postnatal musculoskeletal pain problems, subjects of the study group were educated about proper use of body mechanics during baby caring and daily activities. Also exercises were given to improve posture, each with 5–10 repetitions, minimum three times a day, especially after breastfeeding [16, 23]. Women were informed about the anatomy, functions and importance of the pelvic floor, and exercises were recommended with ten repetitions for both slow and fast twitch muscle fibers, during each breastfeeding. They were also recommended to contract their pelvic floor during activities increasing intra-abdominal pressure (such as laughing, sneezing and coughing) [16, 23, 24]. These education and recommendations were given to the control group before discharge. Physiotherapy program was carried out by the same physiotherapist (İÇK).

Statistical analyses

Descriptive variables were presented as percentages. Inter-group and intra-group analyses of quantitative variables were performed by Student *t*-test. Chi-square test was used for inter-group comparison of the qualitative data. Intra-group time-dependent changes were investigated by one-way ANOVA in repeated measurements, and in order to find out the superiority of the groups, variables belonging to each measurement time, was compared by independent samples *t*-test. Relation of different variables was investigated by Pearson correlation analyses. All quantitative evaluations were performed from the operation to the discharge day. However, since the time of discharge varied between subjects, data of first 3 days (operation day, postoperative first and second day) were included in the statistical analyses, since were common in all subjects.

Table 1 Physical characteristics and obstetrical history of the subjects

	Study group ($X \pm SD$)	Control group ($X \pm SD$)	t	p
Physical characteristics				
Age (years)	30.46 ± 5.69	30.83 ± 6.32	−0.219	0.828
Height (m)	1.63 ± 0.06	1.63 ± 0.05	0.414	0.681
Body weight (kg)	77.62 ± 11.43	77.48 ± 11.45	0.042	0.967
Body mass index (kg/m^2)	29.18 ± 4.18	29.50 ± 5.22	−0.233	0.816
Obstetrical history				
Gravida (*n*)	2.23 ± 0.91	2.67 ± 1.13	−1.510	0.138
Parity (*n*)	1.62 ± 0.75	2.17 ± 1.05	−2.147	0.037*
Abortus (*n*)	0.50 ± 0.81	0.29 ± 0.62	1.011	0.317
D&C (*n*)	0.50 ± 0.65	0.42 ± 0.58	0.476	0.636
Cesarean section (*n*)	1.23 ± 0.51	1.46 ± 0.83	−1.172	0.247
Duration of gestation (day)	261.73 ± 8.73	257.75 ± 21.29	0.877	0.385

*$p < 0.05$

Table 2 Health problems of the subjects before and during pregnancy

	Study group,*n* (%)	Control group, *n* (%)	χ^2	p
Before pregnancy				
Systemic problems	4 (15)	3 (13)	0.086	0.769
Musculoskeletal problems	11 (42)	7 (29)	0.935	0.333
Neurologic problems	8 (31)	8 (33)	0.038	0.846
Constipation	9 (35)	12 (50)	1.213	0.271
Urinary incontinence	0 (0)	1 (4)	1.105	0.293
During pregnancy				
Systemic problems	8 (31)	10 (42)	0.643	0.423
Musculoskeletal problems	17 (65)	16 (67)	0.009	0.924
Neurologic problems	11 (42)	8 (33)	0.427	0.514
Constipation	11 (42)	16 (67)	2.981	0.084
Urinary incontinence	4 (15)	5 (21)	0.251	0.616

Results

The mean age of the subjects was 30.64 ± 5.94 with a range of 19–42 years. There was no difference between groups when compared for age, height, weight and body mass index ($p > 0.05$) (Table 1). Obstetric history parameters of the groups were similar ($p > 0.05$) except parity, which was higher in the control group ($p < 0.05$) (Table 1). Likewise, number of subjects having health problems before and during pregnancy was similar in both groups ($p > 0.05$) (Table 2).

Time to first ambulation after delivery in the study and the control groups were 6:18 (h:min) and 8:1 (h:min), respectively, indicating that women who received physiotherapy ambulated earlier ($t = -2.532$, $p = 0.015$). During first ambulation, two (7.7%) subjects from the study and five (20.8%) subjects from the control groups experienced pre-syncopal symptoms ($\chi^2 = 1.790$, $p = 0.181$).

Inter-group comparison analysis revealed that time of breaking gas and defecating were earlier in the study group ($p < 0.05$) (Table 3).

Initial incision pain intensity was similar between groups ($p > 0.05$). However, it was lower in the study group in the postoperative first and second day ($p < 0.05$) (Table 3). Incision pain decreased significantly from the operation to the postoperative second day, in both groups ($F = 16.868$, $p = 0.000$ in the study group, and $F = 3.794$, $p = 0.041$ in the control group).

The number of analgesic/inflammatory medications needed additional to the standard pain control procedure was 5.04 ± 0.96 in the study, and 5.79 ± 0.78 in the control groups ($t = -3.034$, $p = 0.004$).

Groups had similar amount of difficulty during functional activities in the operation and postoperative second day ($p > 0.05$). However, control group had more difficulty in the postoperative first day ($p < 0.05$) (Table 3). Values

Table 3 Return of intestinal functions after cesarean delivery, intensity of incision pain and amount of difficulty in performing daily activities

	Study group $X \pm SD$	Control group $X \pm SD$	t	p
Return of intestinal functions				
Breaking gas (h:min)	21:00 ± 9:40	27:40 ± 10:35	−2.326	0.024*
Defecation (h:min)	42:42 ± 15:52	57:16 ± 18:11	−3.024	0.004*
Intensity of incision pain (0–10 cm)				
Operation day	6.12 ± 2.68	6.68 ± 3.15	−0.689	0.494
Post-operative first day	3.62 ± 1.73	5.32 ± 2.80	−2.612	0.012*
Post-operative second day	3.52 ± 1.94	5.14 ± 2.80	−2.391	0.021*
Difficulty in daily activities (0–30 cm)				
Operation day	21.02 ± 5.98	24.13 ± 5.88	−1.851	0.070
Post-operative first day	15.68 ± 6.40	20.29 ± 6.31	−2.562	0.014*
Post-operative second day	14.15 ± 6.93	15.80 ± 7.24	−0.827	0.412

*$p < 0.05$

decreased significantly from the operation to the postoperative second day ($F = 22.998$, $p = 0.000$ in the study group, and $F = 22.390$, $p = 0.000$ in the control group).

Intensity of incision pain and amount of difficulty in functional activities were positively correlated for each measurement time ($r = 0.426$, $p = 0.002$ in the operation day, $r = 0.534$, $p = 0.000$ in the post-operative first day, $r = 0.528$, $p = 0.000$ in the post-operative second day).

During the physiotherapy program, no adverse effects were observed in the study group.

Discussion

The results supported our hypothesis, and indicated effectiveness of physiotherapy on incision pain and functional activities in the early post-cesarean period. Also, the need for analgesic medication was lower and return of intestinal functions and ambulation was earlier in the study group.

Groups were homogeneous in of physical characteristics, obstetrical history (except parity, which was higher in the control group) and health problems before and during pregnancy. All subjects had a companion while staying at the hospital. Therefore it may be interpreted that all of them received similar amount of help in case of need during functional activities and while caring for the baby.

In this study, women who received physiotherapy program could ambulate earlier than the control group. Lower extremity exercises and respiratory exercises were shown to help avoiding the effects of anesthetics, preparing the subjects for the effort for ambulation and improving blood circulation [16, 17, 25]. Therefore, it can be considered that physiotherapy applications may have provided desired circumstances for ambulation (no hypotension and excessive uterine bleeding, and being desirous for ambulating) earlier than routine nursing care.

Although not statistically significant, it was remarkable that the number of subjects who had pre-syncopal symptoms during first ambulation in the control group (20%), was approximately threefold of the study group (7%). This parameter needs to be investigated in further studies, involving higher number of subjects.

Breaking gas and defecation—indicators of bowel activity,—were experienced earlier in the study group, although diet programs of the groups were not different. Supportive effects of pelvic exercises providing passive movement of the intestines and stimulation effects of CTM on segmental and cutaneo-visceral reflexes shortly after application were previously presented in studies of Noble and Holey and Lawler [16, 26]. Therefore, it can be suggested that pelvic exercises and CTM played a role in early onset of bowel functions in the study group. Also, earlier ambulation of the subjects in the study may be an additional explanatory factor.

Several researchers have investigated the effects of percutaneous electrical stimulation (PES) and TENS on post-cesarean pain in comparison with placebo or pharmacological methods, and found out successful results [2, 3, 6, 27, 28]. However, the results of studies concerning the effect of TENS on narcotic use after cesarean are conflicting [2, 4, 6].

In this study, the intensity of incision pain decreased significantly from the operation to the post-operative second day in both groups. Although the values of the groups were similar in the operation day, following measurements indicated lower intensities of pain in the study group. Therefore, in parallel to the literature, TENS was considered to be effective in reducing incision pain after cesarean section. Methods such as continuous epidural analgesia or PCA, which are being used in the post-cesarean pain control, have various adverse effects, are expensive, require trained personnel or equipment, and restrict safe and comfortable

movement of the patient [29]. TENS, which was used in this study with the aim of pain control, is an inexpensive method, is easy to use for a physiotherapist, and may be carried on the patient, and therefore does not restrict the movements of the patient.

Also, breathing exercises may have contributed to this result, since they have effects such as improving circulation and healing, and helping relaxation, by causing a mild muscular activity in the abdominal area [16, 17]. In view of the studies explaining the acting mechanism and effects of CTM, it may be questioned if this method may also have played a role in decreasing the intensity of incision pain, since stimulation of the mechanoreceptors by CTM may also close the 'pain gate' via pre and post-synaptic inhibition [21, 22, 30].

Reduced need of medication for pain control in the study group was also considered to be parallel to the lower pain intensities of these subjects. This finding supports the study results of Hollinger [2], who indicated that TENS was effective in reducing the need of analgesia after cesarean, and also in decreasing the amount of medication.

Difficulty in functional activities decreased significantly from the operation day to the post-operative second day in both groups, and was lower in the study group in the post-operative first day. This result was also thought to be parallel to the decreased intensity of incision pain, and may indicate that the recovery of the study group was more rapid than the control group.

Although the length of staying at the hospital was recorded for each patient, effectiveness of the physiotherapy program on this parameter could not be investigated in this study, because mothers were permitted to stay at the hospital until the pediatrics department gave discharge decision for the babies. This parameter may be investigated in further studies involving subjects whose discharge was not delayed because of the health status of their babies.

Also, effectiveness of different frequency, pulse rate, pulse width modulations and duration of TENS applications can be investigated in further comparative studies, and also with other pharmacological or non-pharmacological pain control procedures.

Effects of applications for postural alignment and pelvic floor were not included in this study, since they were not expected to appear in such a short time and were not within the scope of early post-cesarean period. Further studies with longer follow-up periods may be planned to investigate the effectiveness of these applications.

As mentioned in "Introduction", literature samples regarding physiotherapy applications in the early post-cesarean period are mainly related to the effectiveness of TENS on incision pain. The current study includes additional parameters (difficulty in functional activities, time of ambulation, return of bowel activity and analgesic medication need), and various physiotherapy applications directed to these parameters, thus investigates and points out the effectiveness of physiotherapy in a wider perspective. Clinical methods used in this study have many contributing and overlapping effects to each other. Therefore, the findings may not be directly related to the specific effects of the methods, and may be considered as results of an integrative approach.

Randomization per day, which was used in this study, may not seem to be a state-of-the-art randomization technique, since it is easily understandable by probands and evaluators, and may lead to bias. As mentioned in "Materials and methods", this was a single-blinded study, so this suspense may be valid for the evaluator. However, data investigated in this study based on either subjective recordings by the participants or records from patient files. Therefore, for the randomization technique used in this study, probability of leading to bias is considered to be minimal. Lack of a placebo group may be a limitation for this study, since a time-equivalent intervention (such as talking with a caregiver) was not applied to the control group. Therefore, some concern may arise about the genuine physiotherapy effect or effect based on the fact that women in the study group were more intensely cared for, irrespective of what has been done in terms of physiotherapy.

The results of this research are considered to be valuable for obstetricians, physiotherapists and other health professionals who plan and carry out the postnatal health care programs, to increase the quality and productivity of these programs, therefore to improve well-being of the women after childbirth. However, they need to be supported by further studies, including higher number of subjects and free from current limitations, in order to strengthen the evidence.

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Conflict of interest None.

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