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Assessment of the Relationship between Therapeutic Alliance and Pulmonary Function Recovery in Cardiac Surgery Patients Undergoing Physical Therapy

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Abstract

Objective of the study was to assess the relationship between the indicators of therapeutic alliance and pulmonary function recovery in patients undergoing physical therapy after cardiac surgery (CS). 80 patients, who were submitted to CS (performed by median sternotomy on cardiopulmonary bypass) and standardized physical therapy program thereafter. Therapeutic alliance was assessed with the help of Working Alliance Inventory (SF Hatcher Client form) questionnaire. The questions were split into three domains: "goal items", "task items" and "bond items". The questionnaire was filled in on the 7th postoperative day (POD). Pulmonary function test was done before the surgery and on the 7th POD. The results of assessment confirmed a rather high level of therapeutic alliance between cardiac surgery patients and their physical therapists. Lung volumes and flow rates were worse after surgery. According to the analysis of correlation relationships between "task items" indicators and FVC, FIVC, FIV1 reduction rates, patients with less reduction of these volumeshad better "task items" results. According to the analysis of correlation relationships between a number of pulmonary function test indicators on the 7th POD and "goal items", "task items", totalquestionnaire score,patients with higher postoperative pulmonary function values had better therapeutic alliance. The obtained correlation relationships were significant, but weak or very weak. The results confirmed the relationships between postoperative pulmonary function values, their dynamic and therapeutic alliance.

Keywords: working alliance, communication, rehabilitation, therapeutic exercises

Introduction

The patient-therapist relationship has been traditionally regarded as an important determinant of treatment outcomes and considered essential in therapeutic process (Hall, Ferreira, Maher, Latimer, & Ferreira, 2010; Greenberg & Webster, 1982; Bordin, 1979).

Taking into account that physical therapy (PT) is a "person-person" type of work, the study of the relationship between the parties of interaction, their impact on the performance, as well as the comparison of the scores given by both parties of interaction is an important part of studying aphysical therapy process.One of the features of the patient-therapist interactionis therapeutic alliance. Studying therapeutic alliance between the therapist and the patient started with the

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spheres of psychotherapy (Horvath & Symonds, 1991; Martin, Garske, & Davis, 2000) and medical care (Stewart, 1995).

The amount of evidence proving the effect of therapeutic alliance on the possibility of achieving better results andhigher level of satisfaction with physical therapy has been growing (Taccolini Manzoni, Bastos de Oliveira, Nunes Cabral, & Aquaroni Ricci, 2018; Lawford, Bennell, Campbell, Kasza, & Hinman, 2019). There is also evidence that the level of therapeutic alliance influences primary outcomes of function, pain, disability, and global perceived effect in the physical therapy of patients with chronic low back pain (Ferreira et al., 2013). However, according to the results of a systematic review, current studies do not confirm strong relationships between therapeutic alliance and pain relief in patients with chronic low back pain (Taccolini Manzoni et al., 2018). According to another systematic review, therapeutic alliance has a positive effect on physical therapy outcomes; however, additional research is needed to determine the strength of this relationship (Hall et al., 2010).

Most of the researchon therapeutic alliance addresses its impact on physical therapy outcomes in patients with musculoskeletal disorders. Physical therapy of cardiac and cardiac surgery patients remains an important healthcare sphere owing to the prevalence of cardiac pathology, its complications and comorbidity (Vitomskiy et al., 2018; Junior et al., 2019; Vitomskyi, 2020). We have not found any research on the specificities of therapeutic alliance formation in cardiac surgery patients undergoing inpatient physical therapy. It has only been reported that sound therapeutic relationships between patients and staff may play an important role in facilitating the achievement of a wide-range of salutary outcomes during cardiac rehabilitation (Burns & Evon, 2007). Therefore, therapeutic alliance and its impact on physical therapy outcomes in cardiac surgery patients are unexplored.

Purpose: to assess the relationship between the indicators of therapeutic alliance and pulmonary function recovery in patients undergoing physical therapy after cardiac surgery.

Methods
Participants
The study involved 80 patients of both genders, who were admitted to CS. Age Me (25%; 75%) indicators comprised 64 (55.25; 70) years. All procedures were performed by median sternotomy on cardiopulmonary bypass with cardioplegic arrest. The exclusion criteria were: patients with unstable angina pectoris at the moment of selection or during the program, congestive decompensated heart failure, lack of intellectual capacity, complex ventricular and uncontrolled arrhythmia, uncontrolled high blood pressure, cerebrovascular accident. The study protocol was approved by the institutional review board and the local medical ethics committee of GI «Scientific and Practical Medical Center for Pediatric Cardiology and Cardiac Surgery of the Ministry of Health of Ukraine». All patients gave written informed consents.

Interventions
The patients received standardized PT (early mobilization; therapeutic exercises; respiratory PT). Before surgery, the patients were briefly consulted by a physical therapist on the aims and content of PT and activation algorithm after surgery. The postoperative protocol of PT called for the following practice of patient's early mobilization: sitting on the bed with the legs dangling on the 1 POD; standing (getting up with the help and under the control of a physical therapist, holding on a medical movable walker; agreed with an anesthesiologist) and on-the-spot walking if feasible on the 1-2 POD; on-the-spot walking, walking within the ward on the 2 POD; walking in the hospital corridor on the 3 POD; walking up and down the stairs on the 4-5 POD. All patients performed therapeutic exercises with a physical therapist and therapeutic walking under the control of a physical therapist. Sessions (about 20 minutes each) with a physical therapist were conducted 2 times a day on the 1 and 2 PODs, 1-2 times on the 3 POD, 1 time starting from the 4 POD. In case of a necessity (patient's condition, the need for motivation), the physical therapist could increase the number and the length of the sessions.

Outcome Measures
Demographic variables, clinical history were recorded on entry to the trial. All patients were submitted to the pulmonary function test (PFT) before surgery and on the 7 postoperative day (POD). The patients performed at least 3 PFT attempts using Spirodoc MIR spirograph and Winspiro PRO software. Individual rates were calculated automatically according to Knudson/ERS algorithms.

Therapeutic alliance was assessed with the help of Working Alliance Inventory (WAI) questionnaire, SF Hatcher Client form in particular (for a patient), which consisted of 12 questions (Hatcher & Gillaspy, 2006). The scoreswere calculated on a 5-point scale: 5 – always; 4 – very often; 3 – fairly often; 2 – sometimes, 1 – seldom. Besides, the questions were split into three groups/domains: "goal items", "task items" and "bond items". Each of these domains was scored from 4 (minimum) to 20 points (maximum); the total questionnaire score ranged from 12 (minimum) to 60 (maximum) points. The questionnaire was filled in on the 7 POD.

Statistical analysis
The materials of the research were processed in Statistical Package for the Social Sciences 21 program of statistical analysis. Mathematical processing of numerical data was fulfilled with the help of variation statistics. The analysis of quantitative indicators distribution's correspondence to the law of normal distribution was checked by Shapiro-Wilk test. Mean value and standard deviation (M±SD) were calculated for the results of indicators that corresponded to the law of normal distribution. Median value (Me) and upper and lower quartiles (25%; 75%) were calculated for the indicators with a non-normal distribution (results of WAI); besides M±SD was indicated for better analysis. Student's t-test (for dependent groups) was used to measure the significance of the difference, provided there was a normal distribution of study results (PFT results). Spearman's rank correlation coefficient was also usedto study the relationships between the indicators.

Results
The study involved 51 males and 29 females. The average body weight and height indicators comprised 82.54±14.58 kg and 168.29±9.11 cm, respectively, at the time of hospitalization. Body mass index was 28.72 (26.20; 31.95) kg/m2. Left ventricular ejection fraction was 54 (48.3; 59.5)%. The duration of operation and anesthesia was 370 (300; 438.8) min. and 435 (360; 508.8) min., respectively. Artificial lung ventilation lasted 7 (6; 10.75) hours. 5% of the examined patients had stage 1

hypertension, 38.8% and 36.3 had stage 2 and stage 3 hypertension, respectively. NYHA functional classes were the following: I – 15%; II – 30%; III – 55%. 44 patients (55%) had coronary artery bypass grafting; 30 (37.5%) – mitral valve intervention;

33 (41.3%) – aortic valve intervention; 17 (21.3%) – tricuspid valve intervention; 1 patient (1.3%) – aortic intervention.

The specificities of pulmonary function indicators dynamic are presented in Table 1.

Table 1. Indicators of the pulmonary function test (Mean±SD)

Indicators	Before surgery	On the 7th postoperative day	p	t
VC, % predicted	101.80±15.96	73.86±16.47	0.000	16.144
FVC, % predicted	98.91±16.72	71.70±17.62	0.000	14.901
FEV$_1$, % predicted	99.39±18.49	72.44±19.28	0.000	12.982
FEV$_1$/ VC, % predicted	99.08±10.70	100.96±10.32	0.048	-2.019
FEV$_1$/ FVC, % predicted	103.46±10.81	106.04±11.98	0.027	-2.258
PEF, % predicted	96.40±18.34	77.98±19.88	0.000	8.217
FEF$_{25-75}$, % predicted	93.63±34.72	71.67±31.92	0.000	7.055
FIVC, % predicted	93.66±18.20	67.47±17.99	0.000	13.478
FIV$_1$, % predicted	112.03±23.13	81.84±23.54	0.000	13.653
PIF, % predicted	67.25±21.42	55.01±17.66	0.000	6.026

Note. VC – vital capacity; FVC forced vital capacity; FEV$_1$ forced expiratory volume in one second; FEV1/ VC Tiffeneau index; FEV$_1$/FVC Tiffeneau-Pinelli index; PEF peak expiratory flow; FEF$_{25-75}$ forced expiratory flow at 25–75% of forced vital capacity; FIVC forced inspiratory vital capacity; FIV$_1$ forced inspiratory volume in one second; PIF peak inspiratory flow.

Consider the results from the analysis of therapeutic alliance indicators based on the questionnaires filled in by cardiac surgery patients. Me (25%; 75%) indicators in the first questionnaire item (patient's understanding of how he/she might be able to change as a result of the sessions) were 4(3; 5) points, indicators comprised 4.61±5.68 points. Me (25%; 75%) indicators in the second item (the frequency of receiving new ways of looking at the patient's problems as a result of the sessions) were 4(3; 5) points, M±SD indicators comprised 3.71±1.05 points. Me (25%; 75%) indicators in the third item (the patient believes that the physical therapist likes him/her) were 3(2; 4) points, M±SD indicators comprised 3.03±1.23 points. The fourth questionnaire item, which evaluates collaboration between the physical therapist and the patient in setting goals for the therapy, had 4(3; 5) points with M±SD indicators being 3.86±1.14 points. Me (25%; 75%) indicators in the fifth item (mutual respect between the patient and the physical therapist) were 5(4; 5) points, M±SD indicators comprised 4.59±0.76 points. The sixth questionnaire item (joint work of the physical therapist and the patient towards mutually agreed upon goals) was scored by the patients at the level of 5(4; 5) points, with M±SD indicators being 4.41±0.87 points. The seventh questionnaire item (patient's feeling that the physical therapist appreciates him/her) had slightly lower scores: Me (25%; 75%) indicators comprised 4(3; 5) points, with M±SD indicators being 4.06±1.08 points. The eighth questionnaire item (agreement of the physical therapist and the patient on what is important for the latter to work on) had Me (25%; 75%) indicators at the level of 5(4; 5) points; mean value was 4.49±0.81 points. The ninth item (the patient feels the physical therapist cares about him/her even when the patient does things that the physical therapist does not approve of) had Me (25%; 75%) indicators at the level of 4(3; 5) points, with M±SD indicators being 4.13±1.04 points. Me (25%; 75%) indicators in the tenth item (patient's feeling that physical therapy sessions will help to accomplish the changes that he/she wants) comprised 4(4; 5) points, and in the eleventh item (the level of establishing a good understanding of the changes that would be good for

the patient) – 4(3.25; 5) points. Mean values in these items comprised 4.15±0.93 and 4.14±0.95 points, respectively. The twelfth questionnaire item (the frequency of patient'sfeeling that the way of working with his/her problem is correct) had indicators at the level of 5(4; 5) points, with M±SD indicators being 4.48±0.76 points.

The presented analysis (Figure 1) confirms that most patients chose high score answers, i.e. "very often" and "often". The majority of patients chose the answer "sometimes" only in the third item. Me (25%; 75%) indicators among cardiac surgery patients comprised 17 (15; 20) points for "goal items", 16 (15; 19) points for "task items", and 16 (13; 18) points for "bond items". M±SD indicators of these three domains comprised 16.90±2.85, 16.95±6.14 and 15.80±3.06 points, respectively.

It should be noted that the scores were calculated on a 5-point scale, which started with 1 point, not 0. This should be taken into account when analyzing and interpreting the results, particularly when comparing the obtained scoreswith the maximum possible scores. With this in mind, we calculated the percentage of the theoretical maximum for three domains: "goal items" – 80.63%; "task items" – 80.94%; "bond items" – 73.75%.

The total questionnaire score was 50.5 (44; 55) points; M±SD indicators were 49.64±9.14 points, which comprised 77.7% of the maximum, taking into account the specificities of the assessment.

Correlation analysis of domain scores, total score of therapeutic alliance and indicators of decreased pulmonary function (Δ) revealed only three reliable relationships: between "task items" and ΔFVC (ρ=-0.265; p=0.017), ΔFIVC (ρ=-0.242; p=0.031), ΔFIV1 (ρ=-0.263; p=0.018). These relationships confirmed that better therapeutic alliance in "task items" domain corresponded to a less decrease of these three indicators of pulmonary function.

None of therapeutic alliance indicators correlated with the initial results of pulmonary function assessment. At the same time, the analysis revealed a number of correlation relation-
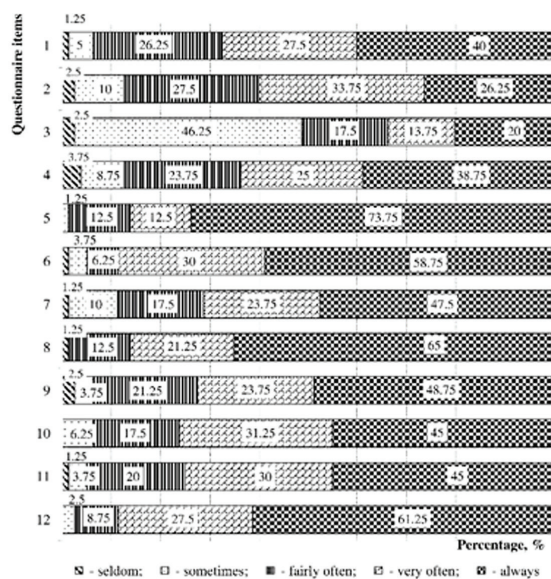
Note. Questionnaire items 1 – «As a result of these sessions I am clearer as to how I might be able to change»; 2 – «What I am doing in therapy gives me new ways of looking at my problem»; 3 – «I believe PT likes me»; 4 – «PT and I collaborate on setting goals for my therapy»; 5 – «PT and I respect each other»; 6 – «PT and I are working towards mutually agreed upon goals»; 7 – «I feel that PT appreciates me»; 8 – «PT and I agree on what is important for me to work on»; 9 – «I feel PT cares about me even when I do things that he/she does not approve of»; 10 – «I feel that the things I do in therapy will help me to accomplish the changes that I want»; 11 «PT and I have established a good understanding of the kind of changes that would be good for me»; 12 – «I believe the way we are working with my problem is correct»; PT – physical therapist.

FIGURE 1. Distribution of patients' responses regarding therapeutic alliance formation in the questionnaire items

ships between PFT indicators on the 7 POD and some indicators of therapeutic alliance. For example, "goal items" domain had a relationship with FIVC ($\rho=0.236$; $p=0.035$); "task items" domain – with VC ($\rho=0.331$; $p=0.001$), FVC ($\rho=0.357$; $p=0.001$), FEV1 ($\rho=0.290$; $p=0.009$), FIVC ($\rho=0.374$; $p=0.001$), FIV1 ($\rho=0.360$; $p=0.001$); total questionnaire score – with VC ($\rho=0.239$; $p=0.032$), FVC ($\rho=0.261$; $p=0.019$), FEV1 ($\rho=0.228$; $p=0.042$), FIVC ($\rho=0.294$; $p=0.008$), FIV1 $\rho=0.242$; $p=0.031$). These relationships confirmed that better therapeutic alliance corresponded to better postoperative pulmonary function values.

Discussion

The results of assessment confirmed a rather high level of therapeutic alliance between cardiac surgery patients and their physical therapists, despite significant specificities in the modalities of the physical therapy program and the length of interaction period. In particular, the modalities (intensive care unit and recovery room, recent complex medical intervention) and the period of program implementation are emotionally and physically difficult for the patient. On the other hand, the patient needs help to restore mobility and independence in self-care at this time, as well to increase functioning level, which provides a solid basis for therapeutic alliance formation.

On the other hand, subjective assessment of the difficulties of postoperative recovery process and physical therapy procedures may vary. Therefore, some patients may find physical therapy procedure or the tasks to be performed (sitting down, standing up, walking) somewhat difficult.

The third questionnaire item had the lowest score, since the answer "sometimes" here was chosen by 46.25% of respondents, whereas "fairly often", "very often" and "always" options were chosen by lessrespondents than in other questionnaire items. The fifth questionnaire item, on the contrary, had the most answers with maximal 5 points. Interestingly, that the third and fifth items refer to the "bond items" domain.

The assessment of correlation relationships between the indicators of therapeutic alliance and pulmonary function revealed three very weak relationships: between "task items" score and FVC, FIVC and FIV1 dynamics. At the same time, the obtained correlation relationships between PFT indicators on the 7POD and some indicators of therapeutic alliance confirmed better therapeutic alliance in patients with better postoperative pulmonary function values.

When commenting on the obtained results physical therapists noted that some patients recovered longer after surgery: they had much more complaints of malaise, weakness, pain, lack of stamina, breathing difficulties within the whole period of hospital stay, and not only during the first postoperative days, when most patients recover almost completely (mobility, self-care) after surgery and anesthesia. Besides, physical therapists noted that it wasmore difficult to work with, connect to and conduct a quality physical therapy program with such patients because of their complaints and subjective conditions. On the other hand, there are very diligent patients with good preoperative PFT values. However, the reduction of their PFT results can reach 40-50%, which can reduce the strength of correlation between therapeutic alliance and pulmonary function dynamic.

This may form the basis for the established relationships and their strength.

As to the influence of patient's attitude to the disease on therapeutic alliance formation, there are evidence, which confirm lower indicators of therapeutic alliance in patients with an irrational attitude to the disease (Fedorenko, Vitomskyi, Lazarieva, & Vitomska, 2019).

Another reason for a very low strength of the revealed correlation relationships may be the fact that pulmonary function recovery does not depend on interventions of the physical therapist, and therefore theoretically it does not depend on patient's diligence and compliance. There is evidence proving that additional respiratory muscle training does not improve PFT values (Dull & Dull, 1983; Jenkins, Soutar, Loukota, Johnson, & Moxham, 1989, 1990; Overendet al., 2001). At the same time, the evidence to support the advantages of one breathing technique over another is currently absent (Lomi & Westerdahl 2013). In this case, the revealed correlation relationships will confirm the fact that patients with better pulmonary function recovery have better therapeutic alliance formation.

Previous studies have shown that therapists' distancing behavior was strongly correlated with short- and long-term decreases in their clients' physical and cognitive functioning. Distancing was expressed through a pattern of not smiling and looking away from the client. In contrast, facial expressiveness, as revealed through smiling, frowning, and nodding, was associated with short- and long-term improvements in functioning

(Ambady, Koo, Rosenthal, &Winograd, 2002).It was also indicated that therapists who spent more time with their patients had a better relationship with them (Sluijs, Zee, & Kok, 1993). However, there is evidence that a special training course for physical therapists, which enhanced biopsychosocial attitudes and beliefs, as well as increased such knowledge and skills did not change the way patients perceived their physical therapists (Overmeer, Boersma, Main, & Linton, 2009).

The results of assessment confirmed a rather high level of therapeutic alliance between cardiac surgery patients and their physical therapists. All PFT values on the 7 POD differed from the preoperative ones. Volume indicators were particularly subject to reduction. According to the analysis of correlation relationships between "task items" indicators and FVC, FIVC, FIV1 reduction rates, patients with less reduction of these volumes had better "task items" results. According to the analysis of correlation relationships between a number of PFT values on the 7 POD and "goal items", "task items", total questionnaire score, patients with higher postoperative pulmonary function values had better therapeutic alliance.

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