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Original Article

Impact of Postoperative Rehabilitation Program on Outcomes of Patients Following Cervical Discectomy

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ABSTRACT

Background: Cervical disc herniation is the most common cause of neck and arm pain in adults. Postoperative rehabilitation is an essential part of the recovery period. **Aim:** The aim of the study was to evaluate the impact of postoperative rehabilitation program on outcomes of patients following cervical discectomy. **Subjects and Methods:** Research design: Quasi-experimental design was used. Sample and Setting: A random sample of 70 adult and old adult patients from both sex was recruited from July 2021 to July 2022, in addition to 6 month follow-up period that ended in January 2023 in the neurosurgery department and neurosurgery outpatient clinic at Assiut University Neurological, Psychiatric, and Neurosurgery Hospital. Patients were assigned randomly by a computer-based selection program into 2 equal groups (control group n=35) and (study group n=35) with a ratio 1:1 assignment. A control group received routine hospital care/instructions while a study group received routine hospital care/instructions in addition to the structured postoperative rehabilitation program by researchers. Tools: assessment sheet for patients undergoing cervical discectomy, numeric pain rating scale, neck disability index, and Newcastle satisfaction with nursing care scale. **Results:** Study findings revealed a statistically significant improvement for both groups, however, improvement was higher in the study group than in the control group (p. value < 0.01) post application of the postoperative rehabilitation program as regards all outcome measures; pain, disability, and satisfaction. **Conclusion:** Postoperative rehabilitation program significantly reduce pain, and disability and improve satisfaction. **Recommendation:** The postoperative rehabilitation program (educational booklet) should be utilized in hospitals as a teaching guide for patients following cervical discectomy for cervical disc herniation.

Keywords: Cervical discectomy, Patients outcomes, Postoperative rehabilitation program

Introduction:

Aging and certain behaviors that contribute to bad neck posture as excessive use of computers and phones are linked to increased incidence of degenerative pathologies of the cervical spine **(Kim and Koo, 2016)**. Cervical disc herniation is a painful and disabling condition manifested by arm and neck pain and may be accompanied by neurological impairments in the affected nerve root. These symptoms are often associated with absence from work as a result of health conditions, physical and psychological disability, and reduced quality of life **(Burneikiene et al., 2015)**.

Cervical disc herniation increases with the aging process, in the age group (51 to 60 years) for both sex. It is frequently common in the third to fifth decades of life. It is more common in females, accounting for more than (60%) of patients. It commonly occurs between (C5-C6) and (C6-C7) vertebral bodies **(Sharrak, and Al Khalili, 2022)**.

Degenerative disc disease was observed with magnetic resonance imaging in 25% of asymptomatic people aged less than 40 years old and in 60% of people aged more than 40 years old. The true incidence is uncertain, however, studies have reported that (51-67%) of adults experience neck and arm pain at some time **(Al-Ryalat et al., 2017)**.

Surgical management of cervical disc herniation is indicated in failure of conservative management or when clinical manifestations of myeloradicular compression are identified, which may cause a recurrent, excruciating, or compressive neurological deficit. Surgical management includes decompression of neural elements and/or stabilization when indicated through the anterior, posterior, or combined approach. The approach selection is influenced by the location of the compressive element, the type of ligament affected, and the overall alignment **(Silva and Almeida, 2021)**.

Following cervical discectomy patients often have difficulty returning to their normal activity which can be limited by pain or fear. Postoperative rehabilitation requires distinct coordinated interventions aimed to improve physical and psychosocial functioning and alleviate residual symptoms **(European Physical and Rehabilitation Medicine Bodies Alliance, 2018)**.

Rehabilitation is an integral part of care after cervical discectomy. Training cervical spine segment stabilizers including cervical multifid and deep cervical flexors help with the management of pain, functional strength, and optimal spinal mobility. These stabilizing muscles showed a significant role in the stability of the cervical spine which directly supports vertebral segments and decreases excessive pressure on the intervertebral disc **(McFarland et al., 2020).**

Patient education has been used to deal with patients' anxiety, pain control, and overall satisfaction **(Fereidouni et al., 2019)**. Nurses should assess patients` abilities and determine their need for assistance with self-care activities. During rehabilitation, the patient must learn to use

specialized equipment and strategies to achieve as much independence as possible in self-care. Instruct patients to use a brace as indicated, avoid excessive bending/twisting of the neck and limit lifting heavy objects. Patients should be informed that walking is the main form of initial exercise after cervical discectomy as it helps prevent blood clots, respiratory complications, and deconditioning. Also, nurses should provide instructions to patients regarding the recommended exercises during the rehabilitation period to facilitate faster recovery, manage residual symptoms, and prevent postoperative complications. **(Peolsson et al., 2019; Spoonamore, 2022)**.

Significance of the study

Patients following cervical discectomy with or without fusion face many problems that affect their daily life and ability to manage activities of daily living. Fear of pain restricts patients to perform certain everyday tasks. So, the researchers developed and implemented a postoperative rehabilitation program for patients following cervical discectomy aiming to help such a group of patients in controlling their pain and reducing fear of doing everyday tasks as a result of pain.

Aims of the study

General objective

The main aim of the study was to evaluate the impact of postoperative rehabilitation program on outcomes of patients following cervical discectomy.

Specific objectives

1. Reduce pain level for patients after application of cervical discectomy postoperative rehabilitation program.
2. Reduce disability level for patients after application of cervical discectomy postoperative rehabilitation program.
3. Investigate patients` satisfaction with nursing care after the application of cervical discectomy postoperative rehabilitation program.

Research hypotheses

1. Patients of the study group would experience less pain than patients of the control group.
2. Patients of the study group would experience less disability than patients of the control group.
3. Patients of the study group would be more satisfied with the nursing care than patients of the control group.

Operational definition

Outcomes: It included pain level, disability level, and patients` satisfaction with nursing care.

Subjects and Methods

Research design

A quasi-experimental design was used to conduct this study.

Study variables

The independent variable was the postoperative rehabilitation program, while the dependent variables were the pain, disability, and satisfaction of patients after cervical discectomy.

Sample size

The power analysis software was used to calculate the patients` sample size, '31' patients in each group would provide at least (80%) power to detect (1.3) unit difference, based on previous studies with a level of significance (0.05). Considering the (20%) dropout rate, the final patients` sample size was 70 (35 per group).

Sample and setting

A random sample of adult and old adult 70 patients from both sex was recruited to the current study from July 2021 to July 2022, in addition to 6 month follow-up period that ended in January 2023. The study was conducted in the neurosurgery department and neurosurgery outpatient clinic at Assiut University Neurological, Psychiatric, and Neurosurgery Hospital. Patients were assigned randomly by a computer-based selection program into 2 equal groups (control group n=35) and (study group n=35) with a ratio 1:1 assignment. The control group received routine hospital care/instructions while the study group received routine hospital care/instructions in addition to the structured postoperative rehabilitation program by the researchers.

Inclusion criteria included patients diagnosed with cervical disc herniation confirmed with magnetic resonance imaging and compatible with a clinical examination by the neurosurgeon and who underwent cervical discectomy with or without fusion with ages ranging from 35- 67 years old.

Exclusion criteria included unconscious patients, patients with a history of cervical surgery or fracture, cervical myelopathy, spinal tumor, or infection.

Data collection tools:

Tool I: Assessment sheet for patients undergoing cervical discectomy:

It was developed by the researchers after reviewing the literature **(Rainville et al., 2017)**. It was used to assess demographic and medical data of the studied patients including age, gender, occupation, education, marital status, height, weight, body mass index, clinical manifestations, cervical disc level, co-morbidities, length of postoperative hospitalization, and with or without fusion.

Tool II: Numeric pain rating scale

It was adopted from **McCaffery and Beebe, (1989**) to measure the level of pain. It is a scale ranging from 0 – 10. Zero means no pain, 1-3 means mild pain, 4-6 means moderate pain and 7-10 means severe pain.

Tool III: Neck disability index (NDI)

It is a self-report patient questionnaire adopted from **Vernon and Mior, (1991)**. It is used to assess how the pain of the neck affects patients' daily life and the degree of patients' self-rated disability with the pain of the neck. It consists of 10 items including pain intensity, lifting, personal care, reading/watching television, concentration, headache, work, sleeping, driving, and recreation. Each item contains 6 answer choices ranging from (0) no disability to (5) complete disability. The overall total score range from 0-50. Interpretation of the total score included: (0-4) = no disability,

(5-14) = mild disability, (15-24) = moderate disability, (25-34) = severe disability, and (> 34) = complete disability.

Tool IV: Newcastle Satisfaction with nursing care scale

It is a subscale of the Newcastle satisfaction with nursing scales adopted from **Thomas et al., (1996)** to indicate the degree of patient satisfaction with each aspect of the nursing care. It consists of 19 items, using a 5-point Likert scale response [1=not at all satisfied, 2=barely satisfied, 3=quite satisfied, 4=very satisfied, and 5=completely satisfied]. The higher degree the greater the patient's satisfaction with nursing care.

Tools validity

The validity of the content of the used tools was tested for relevance, visibility, comprehensiveness, and suitability, it was reviewed by 3 experts at Assiut University (professor of medical-surgical nursing, professor of neurosurgery, and professor of rheumatology, rehabilitation, and physical medicine). Modifications were done to maintain the appropriateness of the content and clarity of sentences.

Tools reliability

The reliability for the numeric pain rating scale (tool II) was (0.95) which was assessed by intra-class correlation coefficients. The reliability for NDI (tool III) using intra-class coefficient correlation was [ICC = 0.88; "0.63 to 0.95"]. The reliability for Newcastle's satisfaction with the nursing care scale (tool IV) using Cronbach's alpha was (0.96)

Procedure

Preparatory phase

Official permission was obtained from the head of the neurosurgery department and outpatient clinic at Assiut University Neurology, Psychiatry, and Neurosurgery Hospital to conduct the study.

Ethical considerations

The ethical committee of the faculty of nursing approved the current research on 28-6-2021. Also, the current research was approved by authorities of Assiut University Neurological, Psychiatric, and Neurosurgery Hospital. Informed consent was obtained from all the studied patients to participate in the current research after a detailed explanation of the nature and aims of this current research. The researchers informed them that their data would be confidential and their participation was voluntary.

Pilot study

It was conducted on "10%" (4 patients from each group) to ensure the applicability and feasibility of research tools and the required time to be completed. Necessary modifications were performed relying on the results of a pilot study. The patients who were involved in a pilot study (4 patients from each group) did not included in the present study sample.

Fieldwork description

Data were collected from July 2021 to July 2022, in addition to 6 month follow-up period that ended in January 2023.

Postoperative rehabilitation program for patients following cervical discectomy (Educational booklet)

It was developed by the research team (the medical-surgical nursing researchers, the geriatric nursing researcher, and the neurosurgeon). It developed in the Arabic language with illustrated photos for every exercise. This booklet was assigned a registration number from The National Library and Archives of Egypt (17692/2021).

The educational booklet was guided by other previously used evidence-based booklets designed for patients having surgical management for cervical disc herniation (**The Edward-Elmhurst Health Orthopedic Center, 2014; Advanced Spine and Joint Institute, 2015; Kaiser Permanente Spine Center, 2015)**. The selected sentences of the booklet were translated from English into Arabic by the researchers and another translation was made by a professional translator who has no medical background. The variations between translations were discussed, compared, and resolved, and a consensus was developed regarding the Arabic wording of each item. Cognitive testing of the translated version of the educational booklet was done by open interviews with 4 patients using the final translated version of the educational booklet and asking patients if they understood clearly all instructions. They were also encouraged to perform the exercises under the researchers` observation. Minor modifications were performed in the final Arabic version of the educational booklet. It was revised and approved by professor of medical-surgical nursing, professor of neurosurgery, and professor of rheumatology, rehabilitation, and physical medicine to ensure the accuracy and validity of the content.

An educational booklet encompasses detailed instructions about:

- A neck brace, bed positioning, bed mobility, transfers, using a walker, using stairs, and activities of daily living.
- Home exercises program (1-2 postoperative weeks): 1 set of 20 repetitions (hold for 30 seconds) twice a day:
    - Shoulder shrugs
    - Scapular Retraction – Initial Phase
    - Horizontal Shoulder Stretch
    - Walking
- Home exercises program (3-12 postoperative weeks):
    - Scapular retraction- progressive phase [1 set of 20 repetitions (hold for 5 seconds) twice a day].
    - Active shoulder flexion [1 set of 20 repetitions (hold for 20 seconds) twice a day].
    - Active shoulder abduction [1 set of 20 repetitions (hold for 20 seconds) twice a day].
    - Chair push-ups [1-2 sets of 10 repetitions (hold for 5 seconds) twice a day].
    - Wall push-ups [1 set of 20 repetitions twice a day]

- Corner stretch [1 set of 20 repetitions (hold for 30 seconds) twice a day].
- Triceps stretch [1 set of 20 repetitions on each arm (hold for 30 seconds) twice a day].
- Horizontal shoulder stretch [1 set of 20 repetitions (hold for 30 seconds) twice a day].
- Walking at least 3 miles a day by 6 weeks postoperative.

- Body mechanics (General rules):

  Standing, bending, turning, lifting, reaching, pushing versus pulling, sleeping, personal, around the house, lifting and handling children, use of computer and car.

Assessment phase

Based on the inclusion criteria, patients were randomly assigned into 2 equal groups (35 for each); using a computer-based selection program.

All patients were assessed preoperatively for demographic and baseline medical data (tool I). Also, they were assessed preoperatively for their pain level (tool II) and disability (tool III).

Implementation phase

All patients received routine hospital instructions which included medication, suture removal after 4-5 days, and wearing a collar for one month postoperatively.

During the preoperative period, each patient of the study group received additional instructions and training from the researchers and received a copy of the postoperative rehabilitation program (educational booklet) to facilitate practicing and commitment to the postoperative rehabilitation program. The study group was given a complete explanation of the postoperative rehabilitation program by the researchers on an individual basis (each patient was met for 2 sessions). Each session took about "40-50 minutes". The sessions were established in the morning and afternoon shifts. Patients were encouraged to perform the exercises under the researchers` observation to ensure the correct manner of performance and avoid complications that may result from incorrectly performing exercises. To ensure patient support, one family member was allowed to present in the sessions. The researchers clarified and simplified any points that the patients did not understand.

The researchers arranged with all patients (study and control groups) the time and place for follow-up (weekly by telephone) to minimize patients' transportation and avoid patients` exhaustion. Then every 2 months to 6 months in the outpatient clinic of neurosurgery at Assiut University Neurological, Psychiatric and Neurosurgery Hospital. The researchers ensured the commitment of patients of the study group to implement the exercise rehabilitation program correctly by telephone weekly.

Evaluation phase

Pain level (tool II) and neck disability (tool III) for the study and control groups were evaluated after 3 and 6 months postoperatively in the outpatient clinic of neurosurgery to evaluate the effect of the routine hospital instructions (control group) versus routine hospital instructions in addition to postoperative rehabilitation program (study group) on patients outcomes.

Also, patients' satisfaction with nursing care was evaluated at the end of follow-up (after 6 months) for all patients in both groups to evaluate patients' satisfaction with the care provided.

All patients of the study and control groups attended the follow-up sessions. Every follow-up session took approximately 30-40 minutes.

Statistical analysis

All statistical analysis was performed utilizing SPSS for Windows version (22.0). Data were tried for normality of distribution earlier to any calculations. Continuous data were regularly distributed and were expressed in mean ± standard deviation (SD). Categorical data were expressed in numbers and percentages. Fisher exact test, chi-square test, and free t-test, were utilized to compare results all through the rehabilitation program stages and to compare preoperative, after 3 months of postoperative rehabilitation, and after 6 months of postoperative rehabilitation. Statistical significance was set at "p<0.05".

Results

Table (1): Shows that no statistically significant differences were found between the study and control groups as regards demographic data (p. value > 0.05). More than half of the studied patients in the study and control groups were male (51.4%, 60% respectively) with mean age (58.6±10.5, 56.54±9.71 years respectively). The majority of them were married (91.4%, 80% respectively) and working (82.85%, 65.71% respectively). A high percentage of them were educated (74.28%, 57.14% respectively).

Figure (1): Illustrated that no statistically significant difference was found between the study and control groups as regard body mass index (p. value > 0.05). Less than half of the studied patients in the study and control groups were obese with a body mass index ≥ 30 (42.90%, 45.70% respectively).

Table (2): Shows that no statistically significant differences were found between the study and control groups regarding medical data (p. value > 0.05). More than half of patients in the study and control groups had a cervical disc level 5-6 and managed with fusion (74.3%, 80% respectively). Less than half of the patients in the study group (45.7%) and more than half of the patients in the control group were having hypertension (54.3%). Fewer percent of the study and control groups were having diabetes mellitus (22.9%, 28.5% respectively).

Figure (2): Demonstrated that no statistically significant difference was found between the study and control groups regarding symptoms of the cervical disc (p. value > 0.05). More than three-quarters of patients in the control group complained of neck pain (80%) and more than half of them complained of arm pain (51.4%) and fewer percent complained of numbness (8.5%). More than half of the patients in the study group complained of arm pain (71.4%) and less than half of them complained of neck pain (42.8%) and more than one-quarter complained of numbness (8.5%).

Figure (3): Illustrated that a highly statistically significant difference was found

among patients in the study group regarding pain level (p. value = 0.0001). More than half of the patients in the study group (60%) were having moderate pain in the preoperative period. Less than half of the patients in the study group (45.7%) were having no pain after 3 months postoperatively while two-thirds of them were having no pain (74.3%) after 6 months postoperatively.

Figure (4): Illustrated that a highly statistically significant difference was found among patients in the control group regarding pain level (p. value = 0.0001). More than half of the patients in the control group (68.5%) were having moderate pain in the preoperative period. Less than half of the patients in the control group (40.0%) were having no pain after 3 months postoperatively while less than one-third of them were having mild, moderate, and no pain (28.6.%) after 6 months postoperatively.

Table (3): Shows that a statistically significant difference (p.value = 0.0001) was found between NDI (preoperative and after 3 months) of the application of the exercises rehabilitation program for a study group. A statistically significant difference (p.value = 0.0001) was found between the study and control groups regarding NDI (preoperative, 3, and 6 months postoperative).

Table (4): Clarifies that the ages of patients have a statistically significant relation with NDI score (P.value 0.020) and cervical disc level (P.value 0.0370). Patients with advanced age showed greater disability scores.

Figure (5): Illustrated that a highly statistically significant relation was found between pain level and cervical disc level (p. value = 0.001). Patients with C 5-6 had greater pain level than those with C 4-5.

Table (5): Shows that patients with fusion have a statistically significant relation with pain level (P.value 0.005). Patients with fusion showed greater pain level than those without fusion. Non-statistically significant relation (P.value 0.302) was found between patients with or without fusion and NDI score.

Table (6): Clarifies that a highly statistically significant difference was found between the study and control groups regarding the mean score of the Newcastle nursing satisfaction scale (P. value 0.001). Patients of the study group showed more satisfaction than patients of the control group.

Table (7): Shows that a highly statistically significant relation was found between patients' satisfaction with nursing care and pain level (P.value 0.0001). Patients who experience no or less pain level were more satisfied with the nursing care.

Table (8): Shows that a highly statistically significant relation was found between patients satisfaction with nursing care and disability level (P.value 0.001). Patients who experience no or less disability level were more satisfied with the nursing care.

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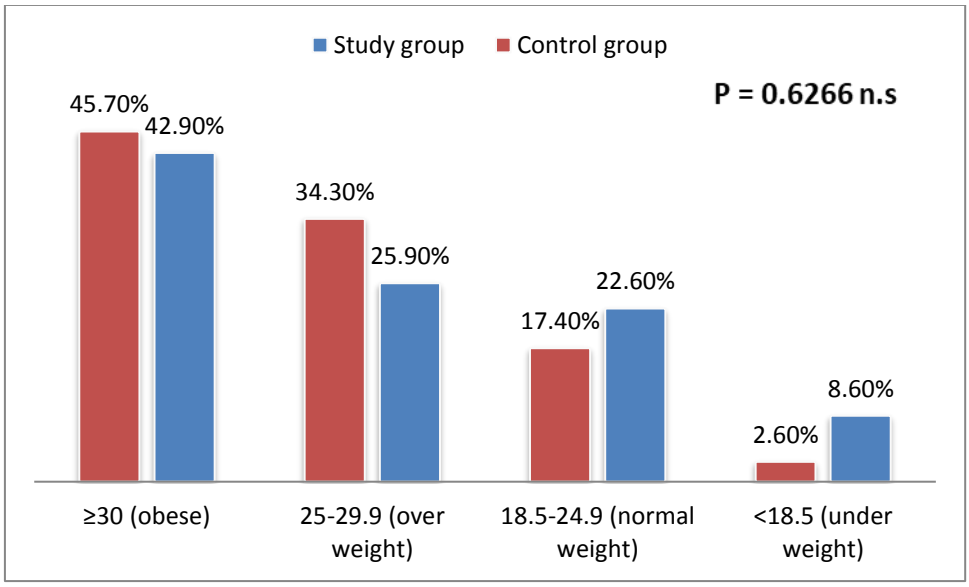
Table (1): Demographic characteristics for study and control groups

Demographic data	Study group (n=35)		Control group (n=35)		P-value
	No.	%	No.	%	
Age (35 - 67 years)					0.4472 n.s
35<50	7	20.0	10	28.6	
50<65	12	34.3	14	40.0	
≥65	16	45.7	11	31.4	
Mean+SD	58.6±10.5		56.54±9.71		
Sex					0.4703 n.s
Male	18	51.4	21	60.0	
Female	17	48.6	14	40.0	
Marital status					0.171 n.s
Married	32	91.4	28	80.0	
Single	3	8.6	7	20.0	
Occupation					0.0707 n.s
Manual work	5	14.4	3	8.6	
Sedentary work	4	11.5	9	25.7	
Heavy work	20	20.0	11	31.4	
Not work	6	17.1	12	34.3	
Level of education					0.4090 n.s
Illiterate	9	25.7	15	14.4	
Read and write	5	14.4	3	37.1	
Basic education	10	28.5	10	28.5	
University education	11	31.4	7	20.0	

Chi-square test P > 0.05



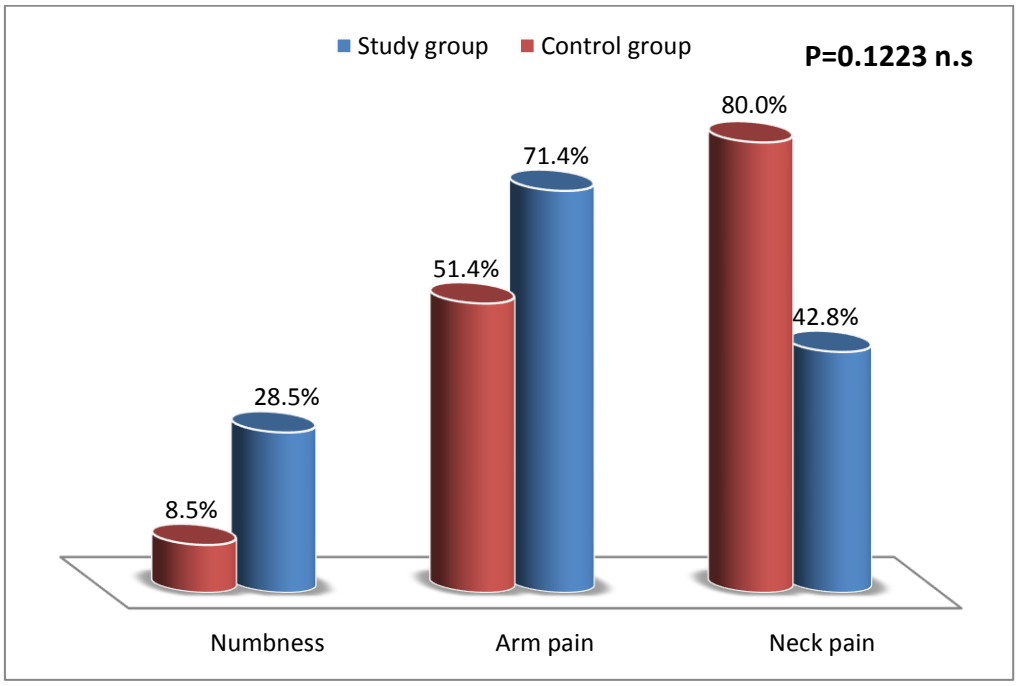
Chi-square test

Figure (1): Distribution of body mass index of patients in study and control groups

Table (2): Distribution of medical data of the studied patients

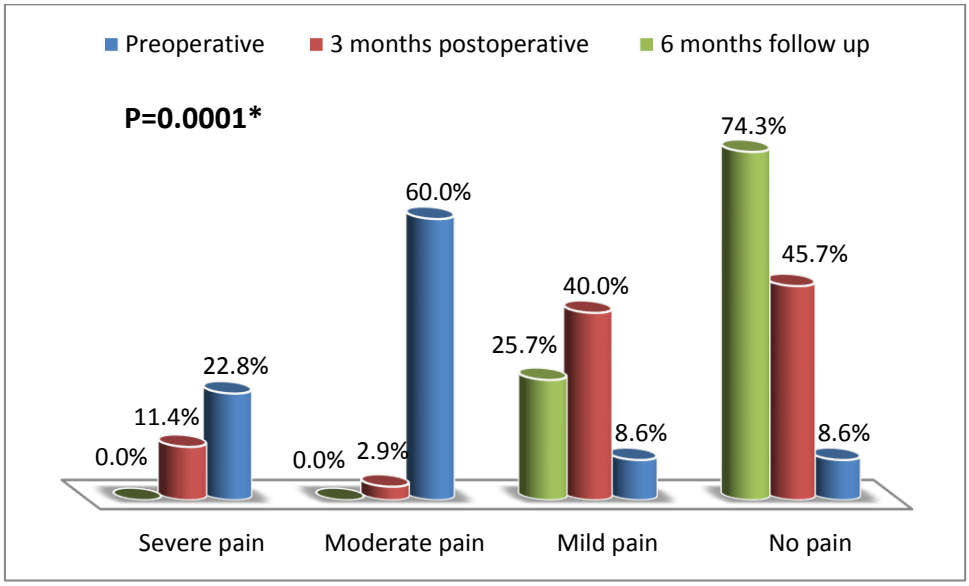
Medical data	Study group (n=35)		Control group (n=35)		P-value
	No.	%	No.	%	
Disc level					
C4-5	12	34.3	11	31.4	0.799 n.s
C5-6	23	65.7	24	68.6	
Fusion					
With fusion	26	74.3	28	80.0	0.569 n.s
Without fusion	9	25.7	7	20.0	
Length of postoperative hospital stay					
2-3 days	26	74.3	29	82.9	0.382 n.s
≥ 4days	9	25.7	6	17.1	
Chronic morbidity					0.377 n.s
Hypertension	16	45.7	19	54.3	
Diabetes mellitus	8	22.9	10	28.5	
No chronic morbidity	11	31.4	6	17.1	

Chi-square test P > 0.05



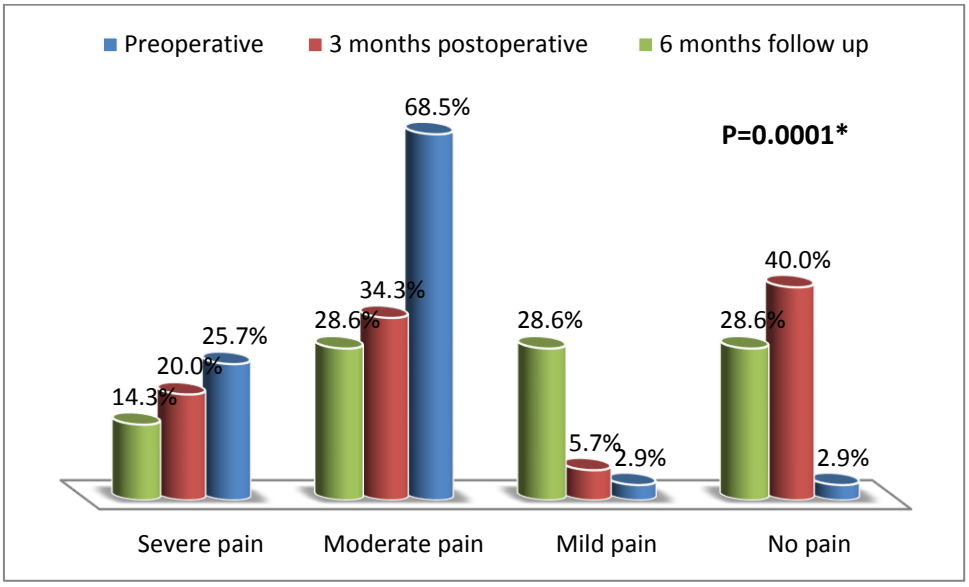
Chi-square test

Figure (2): Distribution of symptoms of cervical disc among patients in both study and control groups



Chi-square test

Figure (3): Distribution of pain rating scale among patients in the study group



Chi-square test

Figure (4): Distribution of pain rating scale among patients in the control group

Table (3): Neck disability index score for study and control groups at preoperative and 3 and 6 months postoperative

Neck disability index	Study group (n=35)						Control group (n=35)						P.value 1
	Pre-operative		3 months post-operative		6 months follow-up		Pre-operative		3 months post-operative		6 months follow-up		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
No disability	1	2.9	18	51.4	25	71.3	9	25.6	18	51.4	10	28.6	* 0.0001
Mild disability	7	20.0	13	37.1	8	`22.9	14	40.0	12	34.2	19	54.2	
Moderate disability	16	45.7	3	8.6	1	2.9	10	28.6	3	8.6	4	11.4	
Severe disability	11	31.4	1	2.9	1	2.9	2	5.8	2	5.8	2	5.8	
P. value 2	0.0001*						0.262						

Chi-square test

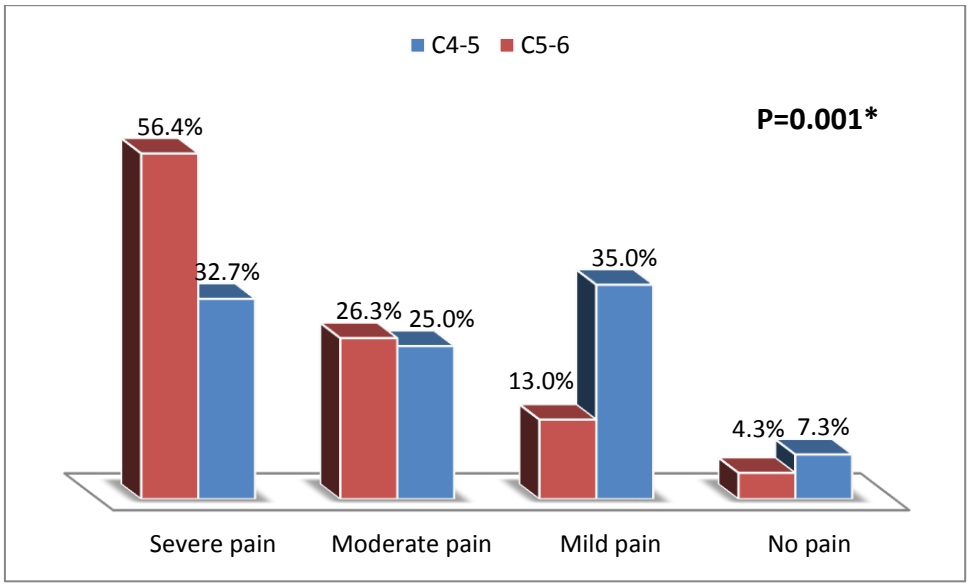
P.value 1: Comparison between preoperative and 3 months postoperative after application of postoperative rehabilitation program for a study group.

P.value 2: Comparison among preoperative, 3 months postoperative, and 6 months follow-up for study and control groups.

Table (4): Relation between age of patients and neck disability index score and cervical disc level

Items	Age (years)					
	35<50 (n=17)		50<65 (n=26)		≥65 (n=27)	
	No.	%	No.	%	No.	%
Neck disability index						
No disability	10	58.8	11	42.3	5	18.5
Mild disability	5	29.4	7	26.9	12	44.4
Moderate disability	1	5.9	2	7.7	8	29.6
Severe disability	1	5.9	6	23.1	2	7.5
X^2 test	15.077					
P.value	0.020*					
Cervical disc level						
C4-5	8	47.1	11	42.3	4	14.8
C5-6	9	52.9	15	57.7	23	85.2
X^2 test	6.590					
P.value	0.0370*					

Chi-square test & fisherman exact test



Chi-square test

Figure (5): Relation between pain level and cervical disc level for the studied patients

Table (5): Relation between cervical discectomy with or without fusion and pain level and neck disability index score for the studied patients

Items	Cervical discectomy with fusion (n=53)		Cervical discectomy without fusion (n=17)		X^2 test	P.value
	No.	%	No.	%		
Neck disability index score					3.643	0.302 n.s
No disability	22	41.6	4	23.5		
Mild disability	15	28.3	9	52.9		
Moderate disability	9	16.9	2	11.8		
Severe disability	7	13.2	2	11.8		
Pain level					12.663	0.005*
No pain	7	13.2	8	47.1		
Mild pain	9	17.0	5	29.4		
Moderate pain	24	45.3	4	23.5		
Severe pain	13	24.5	0	0.0		

Chi-square test

Table (6): Newcastle nursing satisfaction scale mean score between study and control groups

Newcastle nursing satisfaction scale	Lowest	Highest	Mean±SD
Study group	13.19	18.23	18.43±2.14
Control group	8.15	11.97	13.88±1.16
P. value	0.001*		

Free t-test

Table (7): Relation between Newcastle nursing satisfaction scale and pain level regarding study and control groups

Pain level	Newcastle nursing satisfaction scale			
	Study group		Control group	
	Lowest	Highest	Lowest	Highest
No pain	9.25	17.9	11.09	13.79
Mild pain	9.55	16.89	10.89	15.23
Moderate pain	9.69	13.14	14.56	16.15
Severe pain	6.25	10.13	12.50	12.75
Mean±SD	22.18±1.55		17.88±1.16	
P. value	0.0001*			

Free t-test

Table (8): Relation between Newcastle nursing satisfaction scale and disability level regarding study and control groups

Neck disability index	Newcastle nursing satisfaction scale			
	Study group		Control group	
	Lowest	Highest	Lowest	Highest
No disability	5.16	7.9	8.12	13.79
Mild disability	14.20	18.73	12.51	13.23
Moderate disability	9.12	13.41	10.71	14.15
Severe disability	1.25	1.13	4.30	7.57
Mean±SD	18.14±1.26		12.35±0.78	
P. value	0.001*			

Free t-test

Discussion

Cervical discectomy with or without fusion is a commonly performed surgical procedure. Postoperative management for patients following cervical discectomy remains in the scope of rehabilitation research. However, the substantial debate regarding the role of postoperative rehabilitation following this procedure is still present **(Swanson and Leger, 2015)**. Therefore, we sought to determine the current exercise rehabilitation program following cervical discectomy as well as determine the effect of this rehabilitation program on patients` outcomes.

To our knowledge, limited research has been conducted to determine the specific types of exercises performed following cervical discectomy. Therefore, it is essential to establish baseline data in order to develop appropriate and specific programs for comparing different modes of care in postoperative rehabilitation studies.

In the current study, the age in both groups of patients ranged from 35 - 67 years old. A statistically significant relation was found between the ages of patients and neck disability; the degree of severity of neck disability increased with advanced age.

The cervical spine of old adult patients is naturally stiffer and also becomes eventually stiffer after surgery. So, it acquires increasing amount of degenerative changes involving the intervertebral disc, articular processes, posterior ligamentous complex, and posterior longitudinal ligament, leading to impairment in the cervical spine mobility and increasing muscular effort **(Wierzbicki et al., 2015)**.

In the current study, the majority of the studied patients in both groups complained of neck pain and more than half of them complained of arm pain and some of them complained of numbness.

Cervical nerve root compression and inflammatory processes as a result of cervical disc cause neck pain, numbness, or weakness in the arm, and those clinical manifestations can be aggravated by neck movement or use of the arm **(Kang et al., 2020)**.

In the current study, a highly statistically significant difference was found among the studied patients of both groups regarding preoperative, and 3 and 6 months postoperative after application of the postoperative rehabilitation program. However, patients in the study group demonstrated more improvement in pain reduction after 3 and 6 months postoperatively after the application of the postoperative rehabilitation program.

In this regard, the study of **Coronado et al., (2020)** stated that an early self-directed home exercise program is acceptable to patients and safe to practice following cervical discectomy and fusion. Benefits were noted regarding the reduction of neck and arm pain.

From the researchers' point of view, the significant improvements in pain reduction over time in both groups might be due to both groups of patients receiving the same amount of face-to-face

instructions during hospitalization following a cervical discectomy and the same follow-up period, which provided equal opportunities for patients of both groups to ask questions regarding rehabilitation program. The study group demonstrated more improvement in pain reduction after 3 and 6 months postoperatively than the control group and this could be due to the effect of the postoperative rehabilitation program for 6 months postoperatively. The current study assumed 2 sessions of face-to-face instructions, phone follow-up, and illustrated booklet to instruct and follow training, for the study group. A neck brace, appropriate posturing, neck, and arm exercises, and instructions concerning daily living activities and body mechanics (general rules) such as standing, bending, turning, lifting, reaching, pushing versus pulling, sleeping, personal, around the house, lifting and handling children, use of computer and car apparently improving neck and arm pain.

In the present study, a statistically significant difference was found between NDI (preoperative and after 3 months) of the application of a postoperative rehabilitation program for the study group. A statistically significant difference was found between the study and control groups regarding NDI (preoperative, 3 and 6 months postoperative). Patients of the study group showed less disability than those of the control group.

Patients with cervical disc herniation face significant impact as a result of neck and arm pain and disability. Disability leads to worsening of roles in life, loss of productive days at work with poor general health from being more sedentary in their lifestyle **(Koch et al., 2021)**.

A study result by **Toth et al., (2021)** supported the result of the present study, they reported that physiotherapy/exercises could be a critical and possibly unavoidable step in postoperative rehabilitation of the cervical spine and aid in the healing process. It improved the surgical results by enhancing neck mobility and reducing cervical muscular hypertonia and eventually preventing the onset of chronic postoperative neck and arm pain and reducing/preventing neck disability.

From the researchers' point of view, the significant reduction in neck pain led to absence or less disability level in both groups and this might be due to both groups of patients receiving the same instructions and follow-up period by the health care team. The study group demonstrated no or less neck pain led to absence or less disability level after 3 and 6 months postoperatively than the control group and this could be due to the effect of the postoperative rehabilitation program for a period of 6 months postoperatively. Patients of the study group demonstrated no or less neck pain than the control group which enhanced their abilities to perform daily living activities; personal care, reading/watching television, concentration, headache, work, sleeping, driving, and recreation.

In the current study, a statistically significant relation was found between the age of patients and NDI score and cervical disc level. Patients with

advanced age showed greater disability scores with C5-6.

The clinical manifestations caused by cervical disc herniation vary rely on which nerve root is compressed. Cervical disc level 4-5 cause pain, numbness, and/or tingling that may radiate to the shoulder, and weakness may be felt. Cervical disc level 5-6 cause pain, numbness, and/or tingling may be felt in the hand and weakness may be felt in the upper arms and wrist. These manifestations affect patients` functional level and their abilities to perform daily living activities. The C5-6 is the most common herniate. Degenerative changes in the cervical spine increase with advanced age leading to increase disability level **(Rainsville et al., 2017)**.

In the present study, a highly statistically significant relation was found between pain level and cervical disc level. Patients with C 5-6 had greater pain level than those with C 4-5.

The current study finding was supported by a study by **Edwal et al., (2020)** who conducted a study on 30 patients with single-level cervical disc prolapse and managed surgically with artificial cervical disc replacement or cervical discectomy and fusion. They stated that the most common operated level was C5-6 with increased pain level.

In the present study, patients who underwent cervical discectomy with fusion showed greater pain level than those without fusion.

On the contrary, a study by **Das et al., (2018)** conducted on 50 patients with degenerative cervical spondylosis; 25 of them had undergone cervical discectomy without fusion and the remaining 25 underwent cervical discectomy with fusion, they reported that cervical discectomy without fusion is the better option in symptomatic improvement, less complication and maintaining spinal motion and alignment.

The result of the current study demonstrated that patients in the study group showed more satisfaction with the nursing care provided than patients in the control group. A highly statistically significant relation was found between patients' satisfaction with nursing care and pain and disability levels. Patients who experience no or less pain/disability levels were more satisfied with the nursing care.

The finding of the current study was supported by **Peolsson et al., (2019)** who conducted a study on 140 patients after cervical discectomy for radiculopathy due to cervical disc. They reported that postoperative rehabilitation program showed improvement in functional and clinical outcomes after cervical discectomy led to higher rates of satisfaction.

Similarly, many studies reported that postoperative rehabilitation has a significant and positive impact on improving patients` outcomes, enhancing prognosis, and faster recovery time **(Leng et al., 2022; Curley et al., 2021; McFarland et al., 2020)**.

From the researchers' point of view, patients of the study group were more satisfied with the postoperative rehabilitation educational booklet;

the amount of information provided by the researchers about their conditions, treatment, and rehabilitation. More satisfied with the manner of the researchers and the amount of time in providing detailed explanations about their care. Patients of the study group stated that postoperative rehabilitation is beneficial in improving their outcomes and they were satisfied with the information and interest provided by the researchers during their rehabilitation period, this was demonstrated by the improvement of patients` outcomes in the current study findings.

Conclusions

Postoperative rehabilitation program for patients after cervical discectomy showed a significant reduction in pain and disability levels. It also improved patients' satisfaction with the nursing care provided. Patients with advanced age showed greater disability and those with fusion showed greater pain level. Patients who experience no or less pain/disability levels were more satisfied with the nursing care. Nurses have a significant and effective role in applying postoperative rehabilitation with the guidance and assistance of other healthcare teams to aid in relieving/reducing pain and improving the functional ability of patients following cervical discectomy for cervical disc herniation.

Recommendations

The current study recommends the following:

1. Postoperative rehabilitation program should be recommended and started as soon as possible for patients following cervical discectomy.
2. A postoperative rehabilitation educational booklet, which contained a detailed explanation of the recommended postoperative instructions and exercises with illustrated photos should be disseminated to all patients following cervical discectomy.
3. Replication of the current study on a larger probability sample acquired to be conducted on different geographical areas in Egypt in order to figure out the main aspects of the condition and improve outcome.
4. Similar studies are acquired to be conducted on longitudinal bases for one year as a minimum period for follow-up.

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