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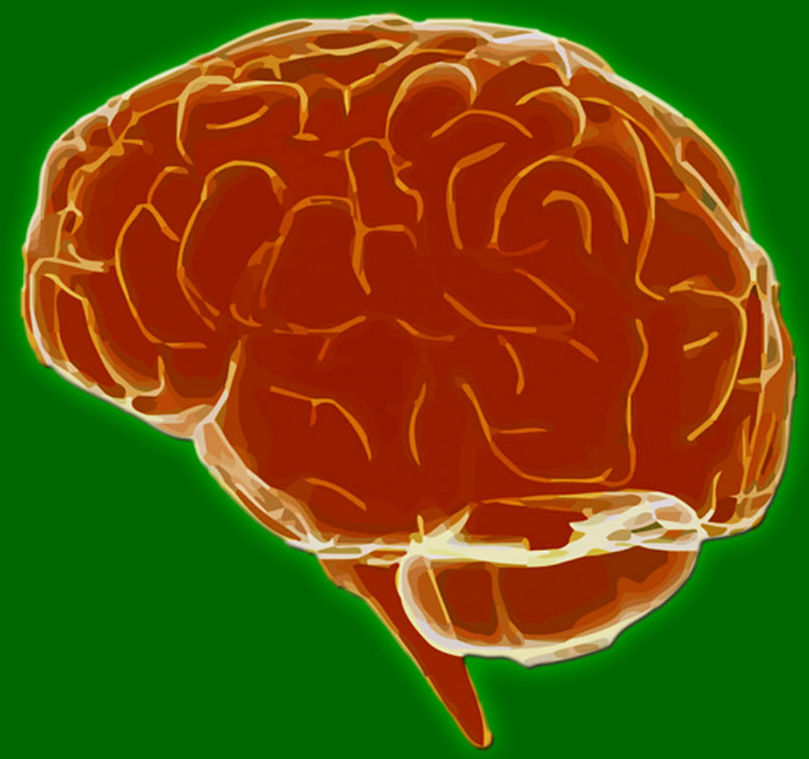

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Iranian Journal of Neurology

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Original Article
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Editorial
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Details

Original and review papers: The maximum length of original and review papers (including tables and figures materials) is 3000 words.

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Iranian neurological events: Include the brief description of major regional events (congresses or seminar) implemented in Iran.

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Manuscripts should be submitted in 12 points, Arial font, with double line spacing and sufficient margins of 2.5 cm.

The text should not be formatted.

Each section of the paper should begin on a new page

The manuscript must include:

Page 1: Title Page

Page 2: Abstract and Key Words

Page 3 and subsequent pages: manuscript body including Introduction, Materials and Methods, Results, Discussion, Conclusion, References, Tables, Figures

1. Title page:

Title page should contain paper title, full names of authors, authors' place of work, full name and address of the corresponding author (including e-mail address and telephone number), given in that order.

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The length of the abstract should be at least 200 and not more than 250 words for original papers and not more than 150 words for review papers and case reports. Abstracts of original papers should be structured to include the background, methods, results and conclusion.

Below the abstract authors should provide between three and six keywords conforming to Medical Subject Headings (Index Medicus).

3. Page three and subsequent pages of the original paper and short communication should include the text arranged in the following order (for other manuscript type, see above):

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2. **Materials and Methods:** Description of the studied population or material should be detailed and include all information necessary to assess the reliability of results obtained in the study and/or allow the experiment to be repeated by other researchers; the section related to statistical analysis should have information on applied statistical tests and programs.

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6. **Acknowledgements:** Should comprise information on sources of funding (grant numbers); acknowledgements should concern those who made a significant contribution to the paper, but who did not meet the criteria to be listed as authors.

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Iranian Journal of Neurology

Original Paper

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Developing Azeri aphasia screening test and preliminary validity and reliability

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Keywords
Screening Test; Aphasia; Azeri Language; Brain Injury; Iran

Abstract

Background: As there is no standard aphasia screening tool for Azeri language yet, the aim of this study was to develop an aphasia screening test with acceptable validity and reliability.

Methods: The present study was conducted in two phases. In the first phase, by literature search, the screening test was designed and to obtain validity it was peer reviewed by expert panel. After collecting experts' ratings and comments, appropriate modifications were applied. For test-retest reliability in the second phase, edited test was administered in 32 patients with brain injuries, then the retest was performed two weeks later.

Results: The developed test had eight subscales including: A) picture description, B) syntax, C) linguistic reasoning, D) descriptive naming, E) perception of minimal pairs, F) comprehensive vocabulary, G) expressive vocabulary, H) verbal fluency. Each section had five questions except verbal fluency which had 3 items. Content validity ratio (CVR) according to Lawshe's approach, was 82% for the whole test. Intraclass correlation for all subscales were more than 0.8. Cronbach's alpha coefficient for internal reliability was 0.901.

Conclusion: This aphasia screening test seems to have acceptable psychometric properties. This test can probably be used in clinical setting by specialists.

Introduction

Aphasia is an acquired neurogenic language disorder.[1] Stroke is the most common cause of aphasia.[2] Aphasia incidence and prevalence is often estimated based on the incidence and prevalence of stroke.[3] The incidence of ischemic stroke in Iranian population was reported to be 43.2 cases per 100,000 person-year. Frequency of aphasia among people who have experienced stroke is 33.3%.[4]

Aphasia screening measures are commonly concise. These tests are helpful in the early stages of recovery, when the patient still cannot complete long aphasia tests.[5] There are several widely used

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tools for screening aphasia in other languages, some of them are being described as follows:

Aphasia Language Performance Scale (ALPS): this tool includes four aspects of language (listening, speaking, reading, and writing) and each aspect has ten-item scale that their difficulty is gradually increased.[6] ALPS is comprehensive in aspects of language but it has limitations for use in research projects.[7]

Acute Aphasia Screening Protocol (AASP): this test has four sub-scales including attention/orientation to communication (five items), auditory comprehension (15 items), expressive abilities (20 items), and conversational style (four items). Although it is short and easily can be done in clinical setting but it has subjective rating system in some sub-scales.[8]

Bedside Evaluation and Screening Test for Aphasia: this tool assesses language ability in three communicative modalities including auditory comprehension, speaking, and reading.[9] It ignores writing which is an important modality in aphasia assessment in English language.

Frenchay Aphasia Screening Test (FAST): it evaluates language in four language areas of comprehension, verbal expression, reading, and writing. Although this test is the most widely used screening tool,[8] but it has limitations. It only applies visual materials, then any visual deficits such as neglect has adverse impact on patient's score.[10]

Mississippi Aphasia Screening Test (MAST): MAST includes nine subscales comprising of naming, automatic speech, repetition, yes/no accuracy, object recognition, following verbal instructions, reading instructions, verbal fluency, and writing/spelling to dictation. It measures receptive and expressive language.[11]

Language Aphasia Screening Test (LAST): this test has two main indexes, receptive and expressive. Receptive index includes naming, repetition and automatic speech; expressive index includes recognition and verbal instructions.[12]

Mini-Mental State Examination (MMSE), Raven's Colored Progressive Matrices (RCPM), and Sheffield Screening Test (SST) are short tests easily implemented, so can be suitable as screening tool[13] but none of them is comprehensive language assessment. In Iran, MAST has recently been translated with cross-cultural adaptation for Persian language.[14]

The lack of valid and reliable test for clinical diagnosis and practice is a worldwide problem.[15] These tests are needed for early detection and intervention. Early detection of language impairments and synergy between intervention and neuroplasticity can maximize the benefits of treatment.[13]

Nevertheless, there is no Azeri Turkish aphasia screening test yet whereas we require a valid and reliable test in accordance with Azeri Turkish language structure and culture for clinical and research application. Azeri language in Iran do not have reading and writing, which can be considered as the most important feature of this language in developing the test. Then, the purpose of present study was developing the screening test of aphasia for Azeri speakers in Iranian population by minimizing limitations in other screening tests and obtaining preliminary validity and reliability as the first step toward standardization.

Materials and Methods

Development of the test

The first section of this study was creating a new test for aphasia screening in Azeri language. Textbooks in linguistics and, language disorders and available screening tests for aphasia were reviewed. In general view, a suitable aphasia test should compromise content expression and comprehension (semantics), form (phonology, morphology and syntax) and pragmatic.[2] With respect to these guides and other literature, eight important domains of language were selected as follows:

1) Picture description (content production): this sub-test helps to assess the semantic and syntactic abilities by evaluating the retrieval of content and function words, and the arrangement of words in the sentence (grammar).[16]

2) Syntax: syntactic processing is damaged in fluent aphasia.[17] Additionally, asyntactic comprehension is one of the high level processing problems in aphasia.[2] Asyntactic comprehension, negative forms, and prepositions are included in this part.

3) Verbal reasoning (pragmatic): in view of the fact that screening test should be sensitive to subtle deficit in cognition and communication, verbal reasoning was selected as part of the test. Verbal reasoning is higher level function that integrate several processes.[18]

4) Descriptive naming (comprehension): this complicated task is naming target items following

verbal description. This task is sensitive to left lobe injuries.[19] It needs language comprehension and word retrieval ability without visual processing involvement.

5) Minimal pairs (phonology): this task taps the auditory input processing without oral production. It can illustrate any problem in auditory analysis level.[20]

6) Receptive vocabulary (single word comprehension): a basic task which assesses semantic input at single word level. Single word comprehension is not seriously disrupted in mild aphasia.[21] Accordingly, Low frequency words were used in various semantic categories in the developed test to rise probability of error.

7) Expressive vocabulary (picture naming): it is reported that there is deficits in picture naming in all types of aphasia.[22] Similar to receptive vocabulary, low frequency words in different semantic categories were included.

8) Verbal fluency (semantic verbal fluency by naming animals): Verbal fluency refer to the number of words which is produced in one minute in specific semantic category; it can be included in aphasia assessment tests.[23]

As Iranian branch of Azeri language does not have writing form and is an oral language, then our screening test was not designed to include reading and writing parts. As mentioned before, the developed test had eight subscales, each subscale had five items except verbal fluency.

Scoring system was 0 or 1 for each item (correct or incorrect answer); then range of score of each part was 0 to 5 except verbal fluency which had a score range of 0-3 (Table 1).

Validity

At the second phase, content validity was determined. First, all the items were included in a questionnaire to verify their relevancy to the content and structure of the test. Then, the sheet with written explanation of our investigation was given to experts including nine experienced speech language pathologists and one linguist. Afterwards, according to expert's opinions the test's materials were modified or unacceptable items were deleted. Finally, ultimate form was obtained (appendix 1). Lawshe's approach was used for determining content validity ratio (CVR) in quantitative way.[24]

Reliability

The reliability was obtained by test-retest and internal consistency evaluation. The test was administered in brain injury and stroke patients who were at risk of aphasia according to neurologist's diagnosis, who were in the early stage of their injury or stroke. Participants included 32 brain injury and stroke patients, 11 female and 21 male with a mean age of 64 years [range: 43-86 and Standard deviation (SD) = 10.0[, who were referred to Imam Reza and Razi Hospitals in Tabriz, Iran. All of them were under medication and were native Azeri speakers. Informed consent was taken according to ethical committee of Tabriz University of Medical Sciences. Participants were assessed for the second time after two weeks.

Results

The patients' scores are shown in each subscale in table 2. Content validity coefficients were calculated for each item in subscales; there were totally 38 items. Content validity coefficient was 40% for four items, 62% for eight items, 80% for seventeen items and 100% for nine items. Since the acceptable CVR is 62%, four items which had CVR less than 62% were modified. Then, the average of the rest of the items was calculated as the content validity indicator. Thus, the whole content validity coefficient was obtained as 82%.

In the second phase of the study, intraclass correlation coefficient (ICC) was calculated for each subscale. Pearson's correlation coefficients of subscales are also presented in table 3.

As for verbal fluency, it was analyzed by the Spearmen's correlation coefficient. The coefficient of 0.899 was obtained for verbal fluency which is well above 0.7. The ICC for this subscale was 0.928.

High Pearson's correlation coefficient between test-retest scores as well as high ICC (above 0.75) showed the acceptable level of test-retest reliability.[25] Cronbach's alpha was used to determine internal consistency of the test. For eight subscales, Cronbach' alpha was obtained as 0.91, indicating a high reliability for Azeri aphasia screening test.

Discussion

An attempt was made to develop a valid and reliable test which encompasses important language domains in multimodality. In descriptive naming, verbal reasoning and verbal fluency items, the stimulus was only auditory and it is useful for patients who has visual deficit. In

Table 1. The subscales and items

Test's subscales	Picture description (content production)	Syntax (comprehension)	Verbal reasoning (pragmatic)	Descriptive naming	Minimal pairs (phonology)	Receptive vocabulary	Expressive vocabulary	Verbal fluency animal's names
Item 1	Father plays with toys	The large glass which is broken	Watermelon skin is red and its inside is green. Is it right?	Wash hands with what?	Dog, rope	Barrel	Flag	No name
Item 2	Mother saw it	The broken flower which is under the table	We can brush our teeth with spoon instead of tooth brush. Is it right?	Children draw with what?	Tongue, teeth	Loudspeaker	Lantern	5 names
Item 3	Son cooks the food	Father of kids who do not say goodbye.	It is possible to put the pen in the pot. Is it right?	What is the name of person who drives airplane?	Park, pitcher	Urceolate (bell)	Funnel	More than 5 names
Item 4	Daughter read the newspaper	The cat that looks the boy	We have breakfast between lunch and dinner. Is it right?	What does the fan exactly do?	King, scarf	Boat	Feather	
Item 5	It is expected that the patient point to relationship between them.	The girls who do not look the boy	It's snowing in the summer. Is it right?	What does the cat eat?	Stone, head	Button	Scale	

Table 2. Descriptive statistics of scores in various subscales of test

Descriptive statistics of scores Subscales	Minimum	Maximum	Mean ± SD
Picture description (content production)	0	4	1.85 ± 1.79
Syntax (comprehension)	0	5	2.62 ± 1.63
Verbal reasoning (pragmatics)	0	5	3.32 ± 1.82
Descriptive naming	0	5	2.45 ± 2.19
Minimal pairs (phonology)	0	5	2.77 ± 1.74
Receptive vocabulary	0	5	3.72 ± 1.57
Expressive vocabulary	0	5	2.35 ± 1.70
Verbal fluency Animal's names	0	2	0.87 ± 0.82

SD: Standard deviation

Table 3. Pearson correlation and intraclass correlation coefficient (ICC) values

Parts of test	Pearson's correlation coefficient	ICC
Picture description	0.787	0.88
Syntax	0.823	0.897
Verbal reasoning	0.832	0.908
Descriptive naming	0.936	0.964
Minimal pairs	0.817	0.892
Receptive vocabulary	0.835	0.91
Expressive vocabulary	0.829	0.906
Total score	0.936	0.966

ICC: Intraclass correlation coefficient

other items, stimulus was visual and it is suitable for patients who has auditory deficit. As mentioned, all language domains including phonology, syntax, semantic and pragmatic were presented in various items. Patient response had two main categories, expressive and receptive, which is similar to screening tests like LAST and FAST. The developed test did not have reading and writing subscales, because of special Azeri Turkish feature, which is a verbal language. The highest score in intraclass correlation in eight subscale was descriptive naming, then verbal fluency, receptive vocabulary, and verbal reasoning. All of these items were present in auditory modality. After these four items, there was expressive vocabulary, picture description, syntax, and finally minimal pairs. These items were presented visually.

Inter-item correlation was utilized to specify the internal reliability. It was the highest in all items for descriptive naming item, then verbal fluency, verbal reasoning and receptive vocabulary, expressive vocabulary, syntax, minimal pairs, and picture description, respectively. This is nearly similar to intraclass correlation. Thus the first four items that all of them were auditory (descriptive naming, verbal fluency, verbal reasoning, and receptive vocabulary) were appropriate for aphasia screening. In the next four items, minimal pairs and picture description, were not proper to this evaluation. Minimal pairs was not in reviewed aphasia screening tests for assessing phonology. However, the expressive vocabulary (picture naming) and syntax sub-tests were apparently more suitable for screening aphasia.

Test-retest reliability was a common approach in determining test reliability. The reliability coefficient for ALPS was reported from 0.83 to 0.94 for aphasic patients; retest was from 3 to 5 weeks after the beginning test.[26] For AASP, another aphasia screening test, test-retest greater than 0.7 was reported.[27] Reliability coefficient ranged from 0.93 to 0.99 for all subscales of Bedsides Evaluation and Screening Test of Aphasia.[9] Criterion validity and test-retest reliability to FAST was reported 0.96 and 0.97, respectively.[10] There was not any report on reliability of MAST.[12] Interrater reliability was obtained for LAST instead of test-retest reliability, thus we cannot compare it with our results. Our aphasia screening test had a 0.93 test-retest reliability, suggesting that the developed test has high temporal stability. It seems acceptable compared to the reliability of other screening test.

ICC of LAST was 0.96, indicating good internal validity and Chronbach's alpha was 0.88, indicating good internal cohesion.[13] Total CVR of the developed test was 0.82 according to Lawshe's content validity table which is acceptable compared to other tests (> 0.62). Therefore, the content validity of this test seems to be appropriate. In this study, we did not calculate criterion validity.

Conclusion

The results of this preliminary study suggested that the developed aphasia screening test for Turkish Azeri language had similar validity and reliability to other screening test in other languages. It seems this test has acceptable psychometric values and it can be used in clinic and research for early diagnosis of aphasia. For further investigation, it is recommended that other types of validity and reliability should be calculated and the test also can be performed in normal population to obtain norm scores of the test.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Original Paper

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Modification of the Persian version of Hermans Achievement Motivation Questionnaire to develop an adapted scale for measuring motivation of post-stroke survivors in Iran

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Keywords
Rehabilitation; Motivation; Cerebrovascular Accident

Abstract

Background: Research has shown that in order for recovery from a stroke to occur, motivation for recovery has been essential component of rehabilitation. Researchers and clinicians have tended to categorize stroke survivors subjectively into two groups: those who have been motivated or unmotivated, perhaps due to the paucity of objective measures that distinguish the groups. Since classification of clients based on subjective inference would be prone to bias, this pilot study aimed to establish a regionally validated scale that was adequately standardized for measuring motivation of adult post-stroke survivors in Iran.

Methods: The Persian version of Hermans Achievement Motivation Questionnaire (PHAMQ) was identified as the best test for the purposes of this study. A multistep process was undertaken to create an adapted scale from the PHAMQ that focused on functional behaviors, often seen in the process of rehabilitation. Thus, the Adapted Achievement Motivation Questionnaire (AAMQ) was examined for reliability and validity. Cronbach's alpha was used for measuring internal consistency and expert panel opinions were sought to analyze the content validity of AAMQ.

Results: A convenience sample of 25 stroke subjects comprised of 10 males and 15 females participated in this study with the mean age [(± standard deviation (SD)] 58.3 ± 9.8 years and range of 35-72 years. Expert opinion regarding the relevance of AAMQ items led to provide compelling evidence for a 28-item AAMQ. Cronbach's alpha of 0.946 showed a perfect internal consistency for test items.

Conclusion: This pilot study suggested that AAMQ could be utilized as a regionally validated scale for examining the motivational level of patients who have sustained strokes in Iran. Further research are recommended.

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Introduction

Cerebrovascular accidents referred to as strokes, have been a common healthcare problem globally.[1] The highest incidence of disabilities that affect everyday activities have been reported among stroke survivors (SS) compared to other common long term health problems such as musculoskeletal disorders and heart conditions.[2] Rehabilitation, a multifaceted time-consuming process, has included behavioral goal-setting and therapeutic intervention aimed to reduce the disability and improve function of SS.[3] Rehabilitation practitioners strive to find validation of outcomes in evidence-based practice[4] for reimbursement. However, the outcome of rehabilitation interventions is depended on how much the client demonstrates that he/she wants to recover. Accordingly, if the client expresses desire to pursue rehabilitation goals, he/she would be considered a motivated client.[5] One correlational study with 200 subjects quantitatively determined that motivation towards treatment played a role in achieving favorable outcomes and predicted the likely functional outcomes of SS.[6]

The World Health Organization described motivation as "a driving force for action" and an essential element of mental function (p.51).[7] While being embedded in the rehabilitation realm, motivation provided a "framework by which rehabilitation professionals and their clients can work together to enhance the client's physical independence and psychological well-being" (p.7).[8] This client-practitioner framework averted clients becoming disappointed while participating in rehabilitation process.[9]

There has been consensus among researchers and practitioners that people who have had strokes fit subjectively into motivated and unmotivated categories.[6,10,11] Categorizing motivation as simply black or white has suggested the bias of subjectivity, perhaps due to the paucity of objective measures. There were only two quantitative studies suggesting some questionnaires that could be utilized for measuring the motivational level of stroke survivors.[12,13]

Hallams and Baker warned the professionals that subjectively assessing the clients' motivation could result in unreal inference about the construct of motivation.[12] Using search words for both motivation and rehabilitation, they developed a two-part questionnaire with 30 items to assess motivation in Australian subjects with strokes. Three experts and three clients with strokes participated in the study to give their opinions, in order for the researchers to determine the content validity of the questionnaire. All the items that were included in the questionnaire were scored a Cronbach's value greater than 0.9, showing that all the items measured the construct of motivation in the field of rehabilitation.

Emphasizing the necessity of developing an instrument for objectively measuring the motivation of subjects with strokes, White et al.[13] devised a 28-item assessment tool, which was adapted from the Sports Motivation Scale (SMS) and re-named the Stroke Rehabilitation Motivation Scale (SRMS). The SRMS, comprised of 7 sets of questions, was tested on 31 Australian participants with acute post-stroke conditions. Based on standardization statistical results such as intra-class correlation coefficients, Cronbach's alpha, and item-to-total correlation coefficients, a final 7-item SRMS was proved to have good reliability among the rest of 28 items, but validity of the questionnaire was not established.[13]

The authors of this paper found no other validated instruments to measure motivation of clients who have had strokes. This gap in the literature justified the specific aim of this study, which was to establish a regionally validated motivational scale that was adequately standardized to measure the motivational level of Iranian SS towards rehabilitation. Thus, our primary objective in this paper was to conduct preliminary research with a number of expert panelists and a sample of SS to provide a Farsi version of a motivation questionnaire, the findings of which could be utilized for future investigations so that the rehabilitation clinical care might be improved by using such questionnaire.

Materials and Methods

To this end, the Hermans Achievement Motivation Questionnaire (HAMQ),[14] was identified as the best test for the purposes of this pilot study because the Persian version of this scale had been developed through forward and backward translation of the scale into Persian with questions adapted to the Iranian culture, and then validated for an Iranian population of students.[15]

The Persian version of Hermans Achievement Motivation Questionnaire (PHAMQ), was chosen for present study for two reasons. Firstly, because this scale has been included a number of different

behavioral domains under one construct, the "achievement motive".[14] Secondly, this scale had been widely used in studies in Iran. The questionnaire contained 29 incomplete statements along with four-choice items for each statement, whereby the responder was allowed to choose one to complete the incomplete sentence. The item choices were scored on a four-point numerical Likert scale from 1 to 4. The scale was used to screen individuals quantitatively for different motivational levels. The scale covered 10 aspects of behavior in order to measure the "achievement-oriented" situation of students when they express specific patterns of academic demeanor such as: being achievement-motivated, persistent, and diligent in doing their academic tasks. The rich quality of the initial item pool with 92 items was the chief importance in construction of this scale.[14] PHAMQ was standardized on 1073 (560 females and 513 males) high school students of city of Saveh, Iran. The test was confirmed to have high reliability with a Cronbach's alpha of 0.803. The validity of the test was also confirmed by performing the construct validity procedure.[15]

Creation of a modified scale from PHAMQ was a four step process, in order to assess the same construct for Iranian adults who had experienced strokes. Firstly, permission was granted for the first author to adapt the HAMQ from its originator. Secondly, the PHAMQ underwent several purposive amendments by the first author, who substituted its academic-oriented performance orientation for a therapeutic task-oriented performance orientation, in order to change the construct to have a rehabilitation focus. Table 1 below shows several examples of some amended items and their corresponding items in PHAMQ. A full version of the adapted scale in Farsi may be obtained from the first author.

Thirdly, a five-person expert panel, comprised of three experienced occupational therapists and two physiotherapists who worked in rehabilitation settings, was created to review the adapted questionnaire for its suitability for stroke survivors. The content validation procedure led to removal of one item, resulting in a new questionnaire with 28 items. The new questionnaire, named the Adapted Achievement Motivation Questionnaire (AAMQ), has a total score of 28 to 112, whereby the higher scores indicated the higher achievement motivation.

The fourth step was to design an observational descriptive study, so that the reliability of the AAMQ could be examined by the means of calculating Cronbach's alpha coefficient for investigating internal consistency. An internal consistency is one type of reliability that determines whether test items of a questionnaire all measure the same behavior or construct. Coefficients higher than 0.7 are considered to be optimal.[16]

Table 1. Examples of amended items and their correspondence

Amended items for the AAMQ	Corresponding items from PHAMQ
"While performing therapeutic exercises, I think perseverance is _____."	"At university, I think perseverance is _____."
Very unimportant	Very unimportant
Rather unimportant	Rather unimportant
Important	Important
Very important	Very important
"My physicians and therapists think I am _____."	"At university, they think I am _____."
Very diligent	Very diligent
Diligent	Diligent
Rather easy-going	Rather easy-going
Very easy-going	Very easy-going
"Good relations with my physicians and therapists _____."	"Good relations with my teachers at university _____."
Are appreciated very much	Are appreciated very much
Are appreciated	Are appreciated
Are not to be so important	Are not to be so important
Are completely unimportant	Are completely unimportant
"I found patients who make more effort are _____."	"At university I found classmates who study very hard are _____."
Very successful	Very nice
Successful	Nice
Not successful	Not nice
Not successful at all	Not nice at all

AAMQ: Adapted Achievement Motivation Questionnaire; PHAMQ: Persian version of Hermans Achievement Motivation Questionnaire

The research project was approved by the Research and Ethics Committee of Shiraz University of Medical Sciences, Iran. Separate consent forms were obtained from the five rehabilitation professionals and participants who had suffered strokes and met the inclusion criteria: willingness to participate, 18-75 years old, sub-acute ictus between 3 to 12 months post-stroke, and presentation of sufficient cognitive and communicative capability to participate in the study. Participants were recruited through a convenience sampling from four rehabilitation centers, which were well-known for offering rehabilitation services to stroke subjects. Molazade et al.[17] study provided sample size guidelines, to calculate the minimum required sample size of 25 subjects, using the sample size equation $N = \frac{(Z_{1-\alpha/2}+Z_{1-\beta})^2 S^2}{d^2}$, where α = 0.05, β = 0.2, d = 4, and mean ± SD of PHAMQ for their population study were 72.8 ± 7.2.

Results

The content validity of the 28-item AAMQ was approved by an expert panel. A convenience sample of 25 subjects who sustained strokes and included 10 males and 15 females was enrolled in this study. The sample mean age was 58.3 ± 9.8 years. The minimum and maximum age of participants was 35 and 72 years, respectively. From the age-related point of view, there was no statistically significant difference between males (59.6 ± 10.2 years) and females (57.4 ± 9.8 years).

The total scale mean was 74.3 (SD 8.1, range 57–94). There was no statistically significant difference between the total score of males (74 ± 6.7) and females (74.5 ± 9.2). Cronbach's alpha of 0.946 showed a perfect internal consistency for test items indicated that all items measure the same construct. Table 2 below shows item-to total correlation that indicated the acceptable correlation between each test item and the total test score. All items seemed to be worthy of retention because they all correlated with the total scale to a good degree (the lowest r = 0.3).

Discussion

The present pilot study examined the statistical psychometric qualities of the AAMQ using a small sample of Iranian subjects who were post-stroke. The content validity and internal consistency demonstrated perfect values. Despite its preliminary character, the research reported here would seem to indicate that AAMQ could be used with some confidence to screen the achievement motivation trait of SS residing in Iran.

Table 2. Item to total correlation between test items and total test score

Item number (Question)	Item-total correlation	Cronbach's alpha if item deleted
1	0.83	0.941
2	0.81	0.941
3	0.83	0.941
4	0.51	0.945
5	0.61	0.944
6	0.85	0.941
7	0.30	0.947
8	0.54	0.944
9	0.87	0.940
10	0.44	0.945
11	0.34	0.946
12	0.76	0.942
13	0.64	0.944
14	0.43	0.945
15	0.45	0.945
16	0.56	0.945
17	0.78	0.942
18	0.69	0.944
19	0.82	0.942
20	0.58	0.944
21	0.43	0.945
22	0.36	0.946
23	0.31	0.946
24	0.62	0.944
25	0.51	0.945
26	0.74	0.943
27	0.44	0.945
28	0.77	0.942

Maclean and Pound[10] argued that motivation was a highly subjective concept with a lack of clinical consensus regarding its definition. They alluded to some sort of "acceptable modes of patient behavior in rehabilitation" (p.497), as an indication of the inferences made by the rehabilitation professionals about the demeanor of clients, with regard to their willingness or unwillingness to participate in rehabilitation interventions.[10] Having considered the disadvantages of subjectively categorizing the stroke survivors' motivation into high and low level terms, it can be argued that the scale developed in this study provided preliminary supportive evidence for quantitatively classifying subjects with strokes by levels on a motivation continuum.

Following the three-part validity assessments, according to the 'trinitarian' model of validity,

content validity was only considered in this study. The other two parts are criterion-related validity and construct validity which lead to gathering further supportive evidence about the validity of a test.[18]

Comparing the scores obtained from an instrument with the scores of a measure of interest, which is called criterion or gold-standard, is the method of determining the criterion-related validity of an instrument.[19] It was not possible to determine criterion validity of AAMQ because there was no regionally standardized measure for comparison at the time of the study. However, one suggestion for future studies would be to design correlational research in order to evaluate the statistical relationships between the AAMQ and other scales, such as Connor-Davidson Resilience Scale (CR-RISC), which was standardized on a sample of Iranian subjects who had experienced strokes.[20] CR-RISC was also originally reported to measure achievement motivation as its latent construct factor in a sample of Iranian students.[21]

Factorial analysis, one of the most frequently used statistical strategy for evaluating the construct validity,[16] was also impossible to perform in the present study due to the small sample size. However, as Hoomon and Asgari argued, there were 7 factors that described the latent construct of the PHAMQ.[15] The factors were perseverance, self-esteem, time-perception, seeking opportunities, diligence, competency, high ambition, and foresight. There is, perhaps, some truth in the idea of yielding the same factors from the adapted scale standardized in the present study.

This pilot study addressed the need to develop a Farsi version of a motivation questionnaire and examined whether the questionnaire had a minimum acceptable level of validity and reliability. This study allowed the authors to examine the content validity and internal consistency (reliability) of the AAMQ. Further research should be accomplished with a larger sample population to determine the other types of validity and reliability. In addition, conducting research on a larger sample size for statistical comparison to other rehabilitation outcome measure questionnaires would be required to determine the usefulness or clinical utility of AAMQ in classifying the subjects into different kinds of motivational groups.

Conclusion

The findings of this pilot study were promising. The AAMQ could be utilized by researchers and clinicians as an objective measure to examine the motivational level of Iranian patients who have experienced strokes. Rehabilitation professionals could use the tool to classify levels of motivation of clients and recognize need for re-motivation treatment early in the process of recovery. Further, the capacity to quantify motivational levels has implications for identifying those patients that may improve faster with early treatment of post-stroke depression. Having a tool that objectively measures change in levels of motivation can also provide opportunity for Iranian clinicians to measure outcomes of interventions that provide evidence for practice.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Outcome of acute ischemic stroke after intra-arterial thrombolysis: A study from India

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Keywords
Acute; Ischemia; Stroke; Thrombolytic Therapy; Outcome

Abstract

Background: Intravenous recombinant tissue plasminogen activator (rt-PA) is the currently standard treatment of acute ischemic stroke within 4.5 hours of the onset of stroke. Recent studies have looked at the benefits of administration of intra-arterial (IA) rt-PA within 8 hours onset of symptoms. Our objective was to assess the outcome of stroke after administration of IA rt-PA in patients with acute ischemic stroke.

Methods: We recruited 10 consecutive acute ischemic stroke patients with onset of stroke from 4.5 hours to 6.5 hours. The present study was conducted at Yashoda Hospital, Hyderabad, India, between January 2008 and December 2013. All patients underwent stroke subtyping and were administered rt-PA. We measured the thrombolysis in cerebral infarction (TICI) score after thrombolysis and functional outcomes at time of admission, after 24 hours, 30, 60, and 90 days. A good outcome was defined as modified Rankin Scale (mRS) ≤ 2 after 90 days.

Results: Out of 10 patients 9 were men, mean age 56.3 ± 1.8 years and age range from 35-68 years. On stroke subtyping, 6 (60%) patients had large artery atherosclerosis, 3 (30%) had a stroke of indeterminate etiology and 1 (10%) had a stroke of other etiologies. Mean time of recanalization was 6.2 ± 0.5 hours, 7 (70%) patients showed major neurological improvement with a mRS score of ≤ 2 at 90 days and one patient was lost to follow-up.

Conclusion: Our study established good outcome at 90 days after administration of IA thrombolysis rt-PA in acute ischemic stroke.

Introduction

In spite of the wide availability of recombinant tissue plasminogen activator (rt-PA) for the treatment of acute ischemic stroke, stroke still remains the third leading cause of death in developed and developing countries[1,2] and around 10% of patients die within 30 days.[3] The rt-PA is the globally approved drug for treatment of acute ischemic stroke.[4] It has to be administered intravenously (IV) within 3 to

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4.5 hours of the onset of stroke.[4,5] Alternatively intra-arterial (IA) administration of rt-PA is possible up to 8 hours after the onset of stroke.[6,7] In several studies, it has been observed that IA thrombolysis increases recanalization rapidly as compared to IV thrombolysis.[8] Our aim is to investigate the outcome of IA thrombolysis as a mode of treatment in cases of acute ischemic stroke within 6.5 hours of the onset of stroke.

Materials and Methods

This prospective study was carried out between January 2008 and December 2013 at Yashoda Hospital, in Hyderabad, in the state of Telangana in South India. The study population comprised of 10 consecutive patients with acute ischemic stroke. All the patients were recruited within 6.5 hours of the onset of stroke. The World Health Organization defined stroke as rapidly developing clinical signs of focal/global disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin.[9]

Patients who presented with acute ischemic stroke were included in the study if they were admitted in stroke unit with onset of stroke from 4.5 hours to 6.5 hours, with angiographic evidence of intravascular clots in the cerebral arteries by computerized tomography (CT) angiogram or magnetic resonance imaging (MRI) brain angiogram before initiation of therapy, and with National Institutes of Health Stroke Scale (NIHSS) score from 4 to 25.

Patients were excluded from the study if they had intracranial hemorrhage or subarachnoid hemorrhage, more than 6.5 hours after onset of stroke, rapidly improving symptoms, history of arterial puncture at a noncompressible site or lumbar puncture within 7 days, blood pressure > 200 mmHg systolic or > 120 mmHg diastolic, NIHSS score below 4 or more than 25, age more than 80 years, fibrinogen < 120 mg, below 100,000 platelet count, serum glucose levels < 50 mg/dl or > 400 mg/dl, use of anticoagulant in spite of international normalized ratio (INR), current taking oral anticoagulants with prothrombin time (PT) > 15 sec or INR > 1.7, gastrointestinal hemorrhage within 21 days, pericarditis, vasculitis, renal failure peritoneal or hemodialysis, or dementia, history of recent seizures, history of trauma or cardiopulmonary resuscitation or surgery within two weeks, active internal bleeding, pregnancy or delivery within two weeks, and genitourinary or gastrointestinal hemorrhage below 21 days.

All stroke patients underwent a CT scan of the brain to exclude hemorrhagic stroke (Figure 1). MRI and CT angiogram (CTA) or MR angiography (MRA) of the brain were performed. A cardiac evaluation of all the patients was done. Additional tests were performed as required. The stroke specialist reviewed the data and sub-classified the strokes as large artery atherosclerosis, cardioembolic stroke, small artery disease, stroke of other determined etiology, and stroke of indeterminate etiology.[10]

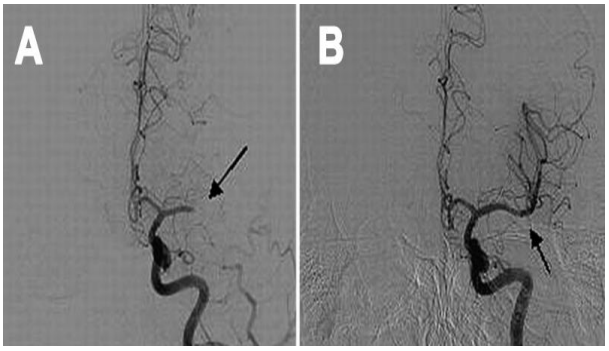

Figure 1. A: Grade 0: No Perfusion, and B: Complete perfusion of left middle cerebral artery (MCA) occlusion followed by reperfusion of recombinant tissue plasminogen activator (rtPA)

Data on all the patients with acute ischemic stroke was collected from their medical records. This included demographic data, evaluation and treatment time, admission and 24 hours NIHSS scores, and time at which onset of symptoms occurred. All the patients were treated with IA rt-PA. The micro-guide catheter (size 5 F) was used to interrupt the clot. After identification of the microcatheter tip (tip length 3 mm) location, 15-20 mg of rt-PA was injected. The onset-to-CT scan/MRI of the brain, and onset-to-recanalization times were noted.

Major neurological improvement was defined as an NIHSS score equal to 0 or 1 at 24 hours or an improvement of ≥ 8 points compared to the baseline.[11] Complications of rt-PA treatment were assessed after infusion and follow-up. All the patients were given 20 mg of rt-PA except 2 patients have received lower dosage (15 mg).

We assessed all patients by Thrombolysis in Cerebral Infarction (TICI) score after treatment: no perfusion, score 0; minimal perfusion, score 1; partial perfusion, score 2; only partial filling (less than two-thirds), score 2a; complete filling in all

arteries but the filling is slower than normal, score 2b; and complete perfusion, score 3 (Figure 2).[12]

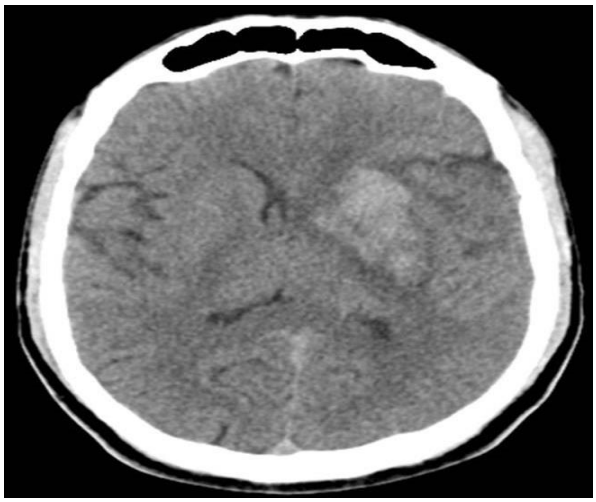

Figure 2. Post thrombolysis CT scan of brain shows hemorrhagic transformation

All patients were followed-up on a regular basis for assessment of outcomes at one week, 30, 60, and 90 days. All patients were also assessed with NIHSS score at baseline, one week, 30, 60, and 90 days. Barthel Index (BI) and Modified Rankin Scale (mRS) score were measured at one week, 30, 60, and 90 days. The predictive value of major neurological improvement at 90 days was analyzed using the mRS score and a good outcome was defined as a mRS score of ≤ 2 at 90 days.[4]

The study protocol was approved by the Institutional Ethics Committee (IEC) and informed consent was obtained from all the participants. If patients were unable to sign the consent forms due to hemiplegia, consent was obtained from the patients' relatives.

Univariate comparisons were drawn where NIHSS scores were recorded and compared at the time of admission, and thereafter at 24 hours and 90 days using the Student's t-test. Similar analysis was performed for BI and mRS scores compared between week 1 and 90 days after stroke.

Results

Seventeen hundred patients presenting with ischemic stroke were evaluated during the study period, 72 (4.2%) patients received IV rt-PA and 10 (0.6%) patients were treated with IA rt-PA. The study population comprised nine men (90%) and one woman (10%). The mean age was 56.3 ± 1.8 years. The prevalence of risk factors among the study population was as follows: 6 (60%) patients had hypertension, 5 (50%) had diabetes mellitus, and 4 (40%) had hyperlipidemia. Out of 10 patients, occlusion was observed in the middle cerebral artery (MCA) in 6 (60%) patients. One patient each had occlusions in the anterior cerebral artery (ACA), posterior cerebral artery (PCA), basilar artery, and T junction (Table 1).

The NIHSS scores was measured at the time of admission, after 24 hours and at 90 days of follow-up (Table 2).

There was a significant improvement in the NIHSS score at 24 hours (6.8 ± 2.2) and at the 90 days follow-up (1.3 ± 1.4) as compared to the score at the time of admission (15.3 ± 1.3) ($P < 0.0001$).

Mean BI (97.5 ± 2.6) and mRS (1.5 ± 1.1) scores were significantly improvement at 90 days follow-up compared to BI (75.5 ± 10.0) and mRS (2.5 ± 1.9) ($P < 0.0010$) scores at 1 week follow-up.

Table 1. Baseline characteristics

Parameters	Number (n = 10)
Men [n (%)]	9 (90)
Mean age (year) (mean ± SD)	56.3 ± 1.8
Age range (years)	35-68
MCA occlusion [n (%)]	6 (60)
ACA occlusion [n (%)]	1 (10)
PCA occlusion [n (%)]	1 (10)
T Junction occlusion [n (%)]	1 (10)
Basilar artery [n (%)]	1 (10)
Hemorrhagic transformation [n (%)]	1 (10)
Hypertension [n (%)]	5 (50)
Diabetes mellitus [n (%)]	4 (40)
Hyperlipidemia [n (%)]	3 (30)
Smoker [n (%)]	3 (30)
Alcoholics [n (%)]	3 (30)
Onset of stroke range (hours)	3-6
Mean time for opening the artery (hours) (mean ± SD)	5.6 ± 0.4
Mean dose of rt-PA (mg)	18.7
Stroke subtyping	
Large artery atherosclerosis [n (%)]	6 (60)
Stroke of indeterminate etiology [n (%)]	3 (30)
Stroke of other determinate etiology [n (%)]	1 (10)

MCA: Middle cerebral artery; ACA: Anterior cerebral artery; PCA: Posterior cerebral artery; rt-PA: Recombinant tissue plasminogen activator; SD: Standard deviation

Table 2. Clinical data on the National Institutes of Health Stroke Scale score at admission and at the 90 days follow-up

Serial number	Site of hemiplegia	Site of occlusion	Time of recanalization after onset of stroke (hours)	Dosage of rt-PA (mg)	mTICI score	NIHSS score on admission	NIHSS score at 24 hours	NIHSS score at 90 days	mRS score at 90 days
1	Left side	MCA	5.5	20	3	16	8	0	0
2	Right side	PCA	5.5	15	2a	18	12	5	3
3	Right side	MCA	6.0	20	2a	15	8	5	1
4	Left side	T Junction	6.0	20	3	17	7	1	1
5	Right side	MCA	6.0	15	3	14	6	0	0
6	Left side	ACA	5.0	20	3	15	4	0	0
7	Right side	MCA	6.0	20	2a	15	10	7	2
8	Left side	MCA	5.0	20	3	14	6	1	1
9	Right side	Basilar artery	5.5	20	3	15	8	6	3
10	Left side	MCA	6.0	20	3	14	5	Lost to follow-up	Lost to follow-up

SL No: MCA: Middle cerebral artery; ACA: Anterior cerebral artery; PCA: Posterior cerebral artery; rt-PA: Recombinant tissue plasminogen activator; NIHSS: National Institutes of Health Stroke Scale

Discussion

The IA thrombolysis is a universally accepted treatment for acute ischemic stroke. We found in our study that 70% of our patients had good outcome at 90 days follow-up. Similar findings were noted by Huded et al. (47%)[13] and Wong et al. (38%).[14] Lisboa et al.[15] analyzed and found that in patients with acute ischemic stroke, outcome was significantly better in patients who underwent IA thrombolysis with low mortality rate compared to control group.

Most of our study patients had IA clots in MCA (6/10) with the remaining few having clots in ACA (1/10) T Junction (1/10), BA (1/10) and PCA (1/10). The IA thrombolysis has been shown to be useful and comparatively safe mode of treatment for selected patients with anterior, middle, and posterior circulation strokes.[16] However, in our study poor outcome was noticed in posterior circulation stroke.

In our study, good recanalization with 70% of TICI grade 3 and 30% of TICI grade 2a was achieved after IA thrombolysis, which were advocated by others.[17-26] In our study, we used only IA rt-PA in patients who were not eligible for IV thrombolysis. Many studies have used a combination of IV thrombolysis and IA thrombolysis.[21]

Huded et al. also evaluated the outcome of isolated IA thrombolysis with urokinase or tpa in their study and showed that 53% had TIMI 2 or 3 recanalization.[13] Mattle et al.[21] compared IV with IA thrombolysis and noted in their study a recanalization grade of TIMI 2 or 3 in 71% after IA thrombolysis and twofold increase of the recanalization with IA compared to IV thrombolysis.

Shaltoni et al.[18] showed that recanalization with TICI flow > 2a occurred in 73% of patients who received IV thrombolysis followed by IA thrombolysis with one of the three urokinase, reteplase, or alteplase. Tomsick et al.[19] in IMS-II demonstrated a TICI 2/3 in 61.3% while a partial or complete recanalization occurred in 74.6% of patients who underwent IV thrombolysis with IA thrombolysis and low energy sonography.

Park et al.[25] studied a combination of early IV thrombolysis followed by IA thrombolysis and showed a recanalization rate after inhospital thrombolysis of 65.2% and outside hospital thrombolysis of 70%.

Qureshi et al.[26] combined treatment on IA reteplase with intravenous abciximab for acute ischemic stroke and demonstrated a recanalization rate of 65%. Heo et al.[23] noted in their study on IA thrombolysis or thrombolytics with or without mechanical treatments, recanalization rate was 60% to 80%.[23]

Although the effectiveness of IA thrombolysis has been demonstrated in randomized clinical trials, several issues about the usage are yet to be clarified. In the present study, we tried to identify the efficacy of IA rt-PA in the treatment of acute ischemic stroke in Indian population. The IA rt-PA advantages are the higher concentration of

medication that directly enters into occluding arteries and less complications of hemorrhagic transformation.[26] All these may lead to a higher recanalization rate as demonstrated by the present study. Further, due to the longer therapeutic window for IA thrombolysis, more stroke patients may benefit in comparison to IV thrombolysis.

Hemorrhagic transformation

In our study we found hemorrhagic transformation in 1 (10%) patient. Studies have established prevalence of hemorrhagic transformation from 4.7% to 25%.[27,28] Lisboa et al.[15] found that intracerebral haemorrhage was significantly higher with IA treatment (9.5%). Shaltoni et al.[18] found a prevalence of intracerebral hemorrhage in 5.8% of patients. Mattle et al.[21] noted that one patient had intracerebral hemorrhage.[22] However, Yoon et al.[24] found no symptomatic hemorrhage in their study.

Outcome

In the present study, we found significant improvement after IA thrombolysis in our patients. The NIHSS score decreased significantly after treatment with IA thrombolysis as advocated by other studies.[28] At 90 days follow-up, good outcome (mRS score ≤ 2) was seen in 7 patients (70%) and poor outcome was seen in 2 patients. A similar study showed at 90 days follow-up an mRS ≤ 2 in 9 and poor outcome (mRS: 3-5) in 3 patients.[25]

Huded et al.[13] showed that 47.1% of patients after IA thrombolysis had mRS score of less than or equal to 2 at 90 days follow up. Lisboa et al.[15] noted that good outcome was significantly higher (41.5%) in IA thrombolysis group compared to control group (23%). Mattle et al.[21] showed in their study that good outcome was significantly increased in IA thrombolysis group (53%) compared to IV thrombolysis group (23%) (P = 0.0200). Nam et al.[29] demonstrated an increase in good outcome by 20% after IA thrombolysis compared to IV thrombolysis. Some studies established IA thrombolysis as more advantageous and independently associated with good outcome,[21] however some studies found poor functional outcomes.[30]

In our study we found two patients with poor outcome (mRS > 3), both had posterior circulation strokes with complete basilar artery occlusion in one and PCA occlusion in the other patient. Macleod et al.[31] noted a good outcome of 50% in their study on IA rterial urokinase in posterior circulation stroke within 24 hours. Voetsch et al.[32] noted 59% with basilar artery occlusion had good outcome. A lower percentage of good outcome (17-40%) was seen by Power[33] after IA thrombolysis in basilar artery occlusion and there was no difference if the treatment was given < 6 hours or > 6 hours after the onset of basilar artery occlusion.

The IA thrombectomy in the posterior circulation is less favourable as it is strongly associated with the futile recanalization. Futile recanalisation is defined as poor outcome even after good recanalisation and may be related to the age of the patient, size of the core infarct and presence of collaterals. Hence, future studies are required in posterior circulation to clarify who will benefit from IA thrombectomy.[34]

Mortality

In our study all our subjects were alive at 90 days follow-up with no mortality, similar to previous studies.[26] Our sample size was small. The mortality rates in other studies are varied and probably depended on multiple factors such as disease severity, time of IA thrombolysis, other comorbidities and duration of hospital stay.[14,22,35,36] Ogawa et al.[35] noted a slightly higher mortality rate of 5.3% in patients who underwent IA thrombolysis with urokinase, compared with control group (3.5%) at 90 day follow-up. Mattle et al.[21] on the other hand, showed a significantly lower mortality rate IA thrombolysis group (7%) compared to IV thrombolysis group (23%) (P = 0.0200). A much higher mortality rate 33% was documented by Natarajan et al.[36] in patients who received IA thrombolysis with other endovascular treatments within 8 hours of onset of stroke at 90 days follow up.

The disadvantages of IA thrombolysis include additional delay because an angiography has to be performed and a microcatheter needs to be placed before commencement of therapy and additional risks associated with the endovascular procedure. With the advent of stent retrievers, studies suggest that IA rt-PA may be less effective compared to the second generation mechanical thrombectomy devices.[37]

However, the stent retrievers are very expensive and can be used only in a few patients in a country like India. On the other hand, IA rt-PA is a reasonably priced easy and efficient method to treat cases of acute ischemic stroke and our experience suggests that the benefit can be

reaped by many.

In our study limitations include the small sample size as it was based on a small, single center involvement, non-randomized design and non-blinded nature of the study without a control group. The strength of our study was that it is a prospective study and recanalisation analysis was done by TICI score with a 90% follow-up rate.

Conclusion

Our study has demonstrated that IA thrombolytic therapy has significant benefit even up to 6.5 hours onset of stroke and might be beneficial in this selected population who are not fit for IV rt-PA. However, multicentric and large scale studies are required to confirm this benefit. The benefits also suggest that a combination therapy of IV thrombolysis and IA thrombolysis may help in our population within the specified time window.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Evaluation of complete functional status of patients with stroke by Functional Independence Measure scale on admission, discharge, and six months poststroke

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Keywords
Stroke; Function; Disability Evaluation

Abstract

Background: To evaluate the patients with stroke by Functional Independence Measure (FIM) scale, at the times of admission to hospital, discharge, and six-month poststroke, and to determine the level of improvement in patients after rehabilitative procedures.

Methods: A total number of 108 patients with stroke entered the study who were admitted to neurology ward. They all received rehabilitation consultation, and occupational and physical therapies were prescribed for them. Finally, their functional status was evaluated by FIM scale.

Results: The median (and range) of FIM scores were 86 (15-119), 102 (16-123) and 119 (17-126) at admission, discharge, and after six-month follow-up, respectively. Our observations showed a significant improvement in FIM scores ($P < 0.001$). About 13, 30, and 76 percent of the patients in individual functional tasks of motor domain and 61, 75, and 86 percent in cognitive domain got the score of 6 or 7 (complete or partial independence) on admission, discharge, and after six months, respectively. There was a reverse correlation between age and FIM improvement and also duration of hospitalization ($P = 0.002$).

Conclusion: The study showed that the FIM is a valid tool for evaluation of patients with stroke, their follow-up and tracking the disease course. Moreover, we concluded that patients with stroke make a significant improvement in their functional status overtime. The exact effect of rehabilitative procedures and comparison with no treatment, must be assessed in separate studies.

Introduction

Cerebrovascular accident (CVA) is the third most common cause of death worldwide, and one of the most common causes of disability in elderly population.[1,2] About 15 to 30 percent of patients with stroke suffer persistent disabilities, and only 13 percent of affected subjects return to work.[3,4]

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Stroke can impact different aspects of subject's life, including gross and fine motor control, mobility, activities of daily living (ADL), mood, speech, comprehension and cognition.

Depending on the involved artery, the size and location of supplied cerebral area and the extent of resulted brain damage, patients might experience various complications. Postural disorders, sensory and motor deficits, hemiplegia or hemiparesis, cognition and comprehension difficulties, memory impairment, decreased self-care and ADL abilities,[5] emotional and mood disorders,[6] sexual dysfunction,[7] and decreased social participation are some typical consequences of stroke. These complications directly affect subject's role fulfillment, and finally lead to decreased patient's quality of life.[8] Functional impairment is a common long lasting sequel of central nervous system (CNS) disorders which can cause patient disability.

One important aspect of clinical research is selecting appropriate measurement tools to quantify the clinical consequences of diseases, effectiveness of applied treatments, and comparison of the results.[9] Since most parameters in rehabilitation field are somehow qualitative rather than quantitative, this requirement is even more prominent.

Planning an appropriate rehabilitation program for stroke patients needs careful and comprehensive assessment of the subjects and their physical and functional condition. Wide range and chronic nature of CVA complications make this necessary to evaluate several aspects of such patients' life, including disability, functional impairment, and quality of life. It is important to consider not only short term, but also long lasting consequences. This can provide the health care system with useful information for planning the rehabilitation protocols.[10]

One useful way to estimate the level of functional independence in CVA patients is evaluation of ADL. A valid tool in this field is Functional Independence Measure (FIM).[4,11] FIM questionnaire was first introduced in 1983. It was presented by American Congress of Rehabilitation Medicine and American Academy of Physical Medicine and Rehabilitation as a promotion of Barthle Index. It is a tool for collection and comparison of rehabilitation outcomes, measurement of patients' progress, and planning treatment protocols. The producers planned it for more precise evaluation of patients' functional status, at different stages of disease.[4,11] ADL, which are the purpose of this test include: self-care, eating, grooming, bathing, dressing, toileting, swallowing, sphincter control, mobility, transfer, and locomotion. It does not include home management activities.

The scale contains 18 items, of which 13 items are in physical domains and 5 items are related to cognition. Motor items measure self-care, sphincter control, locomotion, and transfer. Cognitive ones evaluate subject's communication and social cognition. Based on level of independence, each item is scored from 1 to 7, where 1 indicates total dependence and 7 represents complete independence. Possible scores range from 18 to 126. Obtaining higher score means more independence in ADL FIM score is indicative of patients' level of disability and the burden of their care.[1,4,11]

Subjects are routinely evaluated by FIM questionnaire on admission and discharge from rehabilitation setting.[4,12,13] The questionnaire is easy to apply, and takes a fairly short time to be completed (about 30 minutes for answering questions and 10 minutes for final scoring).

The FIM score has not been applied to Iranian population yet, also the validity and reliability of Persian translation is needed to be approved. The purpose of this study was to apply this tool to assess independence level in Iranian patients with stroke. This study can facilitate more extended use of this scale in rehabilitation settings.

Materials and Methods

It was a descriptive observational study. A total number of 108 patients with stroke took part in the study, in whom the stroke diagnosis (based on clinical and imaging exams) was finally confirmed by a neurologist. Subjects were randomly chosen from stroke patients of General Neurology Ward of Shohadaye Tajrish Hospital, Tehran, Iran, in the time interval between January to September 2012. The inclusion criteria were as follows:

1- It was the first stroke attack.

2- Stroke led to functional impairment.

3- Patients were medically and hemodynamically stable.

4- At least one day was passed from the accident.

5- Patients did not take neuroprotective agents.

Exclusion criteria included:

1- History of previous stroke.

2- Evidence of transient ischemic attack or subarachnoid hemorrhage.

3- History of orthopedic surgeries, malignancy or neurological disorders such as Alzheimer's disease.

4- Any other condition with the potency of causing disability and functional impairment.

5- Patient unwilling to join the study.

After entering the study, patients' medical characteristics, including gender, age, type of stroke (ischemic, hemorrhagic), duration of hospital admission, and their FIM scores, were all documented. Subjects' functional status was assessed using FIM questionnaire on admission, discharge, and six months after the incidence of stroke. The evaluations were accomplished by a physical medicine and rehabilitation specialist. On admission and discharge visits, patient were directly observed by a physician, during the task fulfillment, and the level of independence was detected. Since the true bathing situation was not accessible in clinic, we made an exception about this item and asked it orally. In six-month follow-up visit, we made telephone calls and questioned the patients about their condition, and collected data based on their verbal answers.

In preliminary visit, after explanation of study process, a written consent was obtained from all eligible patients. Each assessment session took about 30 minutes on average, and all visits were accomplished by the same physician.

Patients were admitted by neurology service and referred to rehabilitation specialist by their neurologist. All patients received physical or occupational therapy, during hospital admission. They were also ordered physical and occupational therapies by rehabilitation specialist for the period after discharge, but the rehabilitation program did not happen in a systematic inpatient or outpatient rehabilitation setting.

Data analysis was performed using SPSS software (version 18, SPSS Inc., Chicago, IL, USA). Mean and standard deviation (SD), or median and range (minimum-maximum) were used to present the quantitative scales. For qualitative scales, we obtained the distribution frequency statistics. In order to detect the relations between qualitative scales, the chai-square test was used. We applied Spearman's rank correlation test to find the linear correlation between two quantitative scales. In order to detect the dependence between changes in quantitative and qualitative scales, the Student's t-test or Mann-Whitney U test was performed. If the qualitative scale had more than two conditions, the one-way analysis of variance test (Kruskal-Wallis) was applied. We used LSD (least square deviation) for post-hoc test. Analysis of changes in each subject's FIM score was accomplished by the Wilcoxon test. Friedman test was also performed to detect the meaningful changes in FIM scores. For predicting the death probability, patients' characteristics were analyzed by backward multiple logistic regression test.

Results

A total number of 108 eligible patients entered the program with documented diagnosis of stroke. All patients were visited by an expert neurologist and the diagnosis of CVA was based on their clinical and imaging findings. In later stages, 29 patients died (14 patients during the hospital admission and 15 after discharge). Finally, about 73% of the patients (79 subjects) completed the follow-up visits and their data was analyzed. Patients' characteristics including age, gender, stroke type, and duration of hospitalization are listed in table 1.

Table 1. Demographic characteristics

Variable		Patients entered the study	Patients died	Patients survived to final stage	P*
Number of patients		108 (100)	29 (27)	79 (73)	-
Age**		62 ± 17, (16-91)	73 ± 17, (26-91)	58 ± 16, (16-89)	< 0.001
Age group (year)	< 40	13 (12)	2 (7)	11 (14)	0.002
	40-60	39 (36)	4 (14)	35 (44)	
	> 60	56 (52)	23 (79)	33 (42)	
Gender	Male	70 (65)	19 (66)	51 (65)	0.926
	Female	38 (35)	10 (34)	28 (35)	
Stroke type	Embolic	20 (18)	3 (10)	17 (21)	0.002
	Thrombotic	59 (55)	11 (38)	48 (61)	
	ICH	29 (27)	15 (52)	14 (18)	
Days stayed at hospital***		8 (2-92)	12 (3-92)	6 (2-63)	< 0.001

*P-values determine the significant differences between dead and alive patients; **Mean ± SD (Standard deviation), (minimum-maximum); ***Median (minimum-maximum); ICH: Intracerebral hemorrhage

A higher age was found in expired patients group (P < 0.001). Moreover, the mean FIM score of these subjects was lower, at both admission and discharge visits (P < 0.001). Figure 1 shows the distribution of death rate in different age groups.

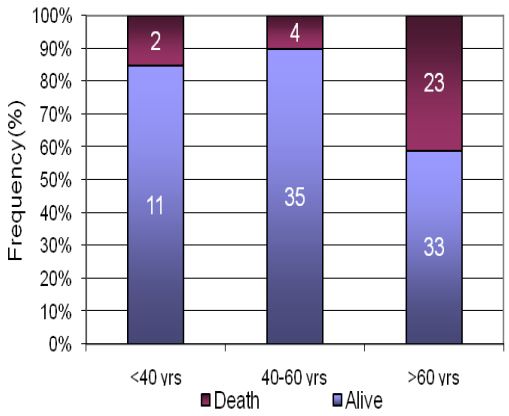

Figure 1. Death frequency among different age groups

Our findings showed that the incidence of death in subjects older than 60 was 11 times and 22 times higher than below 40 and 40-60, respectively. Beside age, the FIM score had an independent effect on the survival rate. It was shown that 10 score increase in initial FIM score resulted in 1.55 times increase in subject's survival rate. Median, minimum and maximum of FIM scores are shown in figure 2.

Table 2 shows the scores of motor (maximum: 91) and cognition (maximum: 35) domains on follow-up visits.

As it is evident, the scores of all categories improved over time (P < 0.001). It is noteworthy that about 13, 30, and 76 percent of subjects achieved the level of independence (score 6 or 7) in individual functional tasks of motor domain (such as self-care and mobility activities), at the times of admission, discharge, and six-months poststroke, respectively. Also, in cognitive domain, about 61, 75, and 86 percent were considered independent at the times of admission, discharge, and six-month follow-up, respectively.

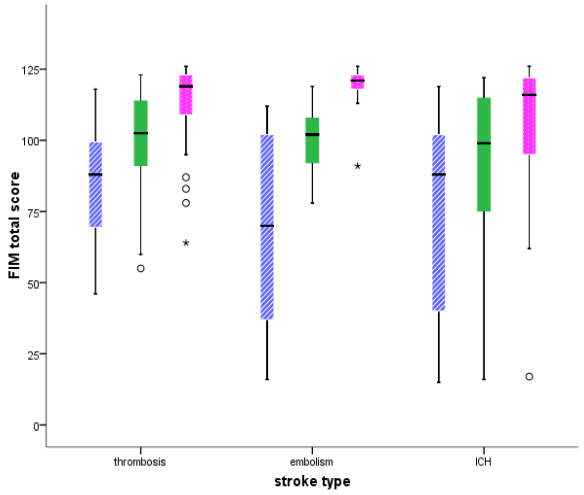

Figure 2. Total Functional Independence Measure (FIM) score distribution at the time of admission, discharge, and six-month follow-up

The study showed that there was a direct linear correlation between each subject's total FIM score and the scores of motor and cognition domains on all follow-up visits. It means that, obtaining a higher score on initial evaluation led to higher scores at the times of discharge and six months later. Also, more independence in motor domain accompanied better cognitive function.

There was a significant inverse relation between subjects' age and their FIM scores, at the times of discharge and six-month follow-up visit (P < 0.001). However, this association was not obtained between age and admission's FIM score. We also observed that the gain in FIM score was inversely linked to the age and it was significantly lower after 60 years old (P = 0.010). We did not observe any association between gender and FIM scores. No significant correlation was observed between type of CVA and FIM scores (Table 3).

Table 2. Patients functional status according to Functional Independence Measure (FIM) score

FIM scale	Admission	Discharge	Six-month follow-up	P
Motor domain score	53 (12-86)	72 (12-88)	86 (12-94)	< 0.001
Cognition domain score	32 (5-35)	33 (5-35)	33 (5-35)	< 0.001
Self-care	23 (5-42)	32 (5-42)	40 (5-42)	< 0.001
Sphincter control	14 (2-14)	14 (2-14)	14 (2-14)	< 0.001
Locomotion	11 (3-20)	14 (3-21)	19 (3-21)	< 0.001
Transfer	7 (2-14)	9 (2-14)	12 (2-18)	< 0.001
Communication	11 (2-14)	13 (2-14)	14 (2-14)	< 0.001
Social cognition	21 (3-21)	21 (3-21)	21 (3-21)	< 0.001

FIM: Functional Independence Measure

Table 3. Correlation coefficient between patients' Functional Independence Measure (FIM) score and other characteristics

		Age	Days of stay at hospital	Total FIM score on		
				Admission	Discharge	Six months
Days of stay at hospital		-0.16 (0.17)	-	-	-	-
Total FIM score at	Admission	0.07 (0.56)	-0.43 (< 0.01)	-	-	-
	Discharge	-0.19 (0.10)	-0.46 (< 0.01)	0.85 (< 0.01)	-	-
	Six months	-0.33 (< 0.01)	-0.33 (< 0.01)	0.53 (< 0.01)	0.79 (< 0.01)	-

The study showed that longer duration of stay at hospital was associated with lower scores of total FIM, and also motor and cognition subscales, on discharge and six-month follow-up visits (Table 2).

The gain in subjects' FIM scores was inversely correlated to the admission FIM score. So subjects with less initial FIM score, showed more remarkable improvement in latter stages. This relation was also observed in motor and cognition subscales (r = -0.66, r = -0.86, and r = -0.63) (Table 2).

Discussion

We observed a significant improvement in total FIM score and also its motor and cognition subscales on follow-up visits. The mean (and range) of total FIM scores were 86 (15-119), 102 (16-123) and 119 (17-126) for admission, discharge and six-month poststroke, respectively. According to some studies, FIM score of more than 108 is roughly indicative of home independence.[14] In our study, subjects achieved this level of independence on six-month follow-up visits.

Based on the study by Beninato et al.[15], the least significant changes for total FIM, motor and cognition scores were 22, 17 and 3, respectively. Compared to their findings our patients showed these least significant changes. Our findings revealed a direct linear correlation between scores of total FIM and its motor and cognition subscales at all follow-up sessions. Considering this, higher FIM score on admission led to higher scores on discharge and six months afterward. These results conformed other studies' findings.[8,16-18]

According to our study, gains in motor domain were significantly higher than cognition. This improvement was specifically observed in category of self-care. Assessment of results revealed a mean increase of 12 (range: 6-80) and 13 (range: 1-40) in total FIM scores at admission and discharge, respectively. Comparison of these findings showed no significant difference. The above statement applied to motor domain too. It was different in cognition domain. The results showed significantly higher improvement in subjects' cognition domain of FIM score during the hospital admission. We observed fairly small changes in patients' cognitive status at staying home periods. On the other hand, about 86% of subjects got the maximum score of cognition domain on six-month follow-up visits. Putting these findings together, it can imply the relative weakness of FIM score in detecting subtle changes of cognitive status. This conclusion is consistent with the results of Hall et al. study.[16] Another study by Tokunaga et al.[19] showed that the gain in FIM score, in completely dependent or completely independent subjects is minimal. According to this, not much of improvement is expected in functional status of these patients.

In our study, the overtime improvement in FIM score was inversely linked to subject's age. The gain in total FIM score and motor domain were significantly lower in those aged over 60. Our findings match the observation of other trials. Studies confirm that older subjects gain lower FIM scores.[17,20,21] Tur et al.[20] found that in addition to age, the time gap between accident and admission to hospital and also initial FIM score are predictive of FIM score at discharge. In our study, the age and FIM score of preliminary visit along with duration of hospital residence significantly affected the FIM score at discharge but age did not have a significant effect on admission and the FIM score at discharge. The FIM score of six-month follow-up visit was significantly affected by age, but there was a rather weak correlation coefficient (-0.33). Tokunaga et al.[19] showed in their study that as the age increased, the admission FIM score and its improvement significantly decrease.

One final objective of stroke rehabilitation is release of patients to home. According to the study by Koyama et al.,[22] higher age and lower FIM scores decrease the possibility of subject's

discharge to home. They also showed that the age and initial FIM were inversely correlated with FIM improvement. These observations are compatible with ours. In our patients, the FIM scores of discharge and six-month follow- ups were inversely correlated with the admission FIM score. This dependence was also observed in motor and cognition domains. Also, assessment of expired patients' characteristics revealed that the age and initial FIM score were good predictors of death. In our study, patient's gender and type of stroke did not affect the FIM scores at admission or follow-up visits. We could not find any study evaluating these two factors.

Our survey on the studies of FIM score showed that it has been used as a measurement device in rehabilitation of stroke, traumatic brain or spinal cord injury, and multiple sclerosis (MS), in elderly and youth populations.[23,24] In a systematic review by Chumney and colleagues[4] in 2010 for validation of FIM questionnaire in stroke patients, they observed that despite its limitations, the FIM score can accurately predict the stroke outcomes. Hamilton et al.[25] evaluated interrater reliability of FIM score, and its motor and cognition domains and also, FIM item score agreement in 1081 patients. Intraclass correlation coefficients (ICC) for total FIM, motor and cognition domain were 0.96, 0.96, and 0.91, respectively. ICC for subscales score ranged from 0.89 (social cognition) to 0.94 (self-care). They concluded that the FIM, when used by trained rehabilitation clinicians, is reliable enough. In study by Kwon et al.,[26] a high correlation was observed between motor component of FIM, Barthel index and Modified Ranking Scale. In another study by Dodds et al.,[27] Uniform Data System (UDS) data on 11102 general rehabilitation inpatients were examined and they conclude that the FIM has high internal consistency. Also, Hall et al.[28] reported a high correlation coefficient between FIM and disability rating scale.

One shortcoming of FIM scale is that this tool evaluates subject's independence in ADL performance, but not the way of its accomplishment. Many neurobehavioral disorders affect the quality of task performance, but not just the happening of it. In such a case, despite final task accomplishment, the occurrence of several errors place obstacles in the patient's way to meet the purpose. Elimination of this defect needs applying more sophisticated and precise measurement tools.

Finally, it is noteworthy that FIM score must be applied by a skilled practitioner. It is self-evident that lack of enough training might threat the measurement reliability. We accomplished the six months follow-up evaluation through a telephone call. There are some studies that used telephone interview for evaluation of subjects' FIM scale.[29] Also in a study by Smith et al.,[30] it was shown that there is good intermodal agreement for telephone assessment using the FIM and in-person assessment. They also demonstrated that the main factor affecting the data collection was subject's communication skills.[30] Despite these, it was better using the version available for telephone interviews and this can be considered as a limitation of our study. The other potential source of bias in current study was relatively wide range of discharge visits. According to our findings, time had a positive effect on patients' FIM scale. Although it was not as wide as some other studies,[31] this difference in timing of follow-up visit might have affected the results.

In current study, we designed the rehabilitative plans subjectively and based on patients' individual needs and deficits. According to our knowledge, a predetermined standard CVA rehabilitation protocol has not been defined yet. Assessment of different rehabilitation plans and comparison of their effects needs to be accomplished in separate clinical trials with precise planning of different rehabilitation protocols. We suggest planning more clinical trials to evaluate the effect of different rehabilitation options.

Conclusion

The study showed that the FIM is a valid tool for evaluation of stroke patients, their follow-up, and tracking the disease course. Also, we concluded that stroke patients make a significant improvement in their functional status overtime. The exact effect of rehabilitative procedures and comparison with no treatment must be assessed in separate studies.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Prognostic value of hemoglobin A1c in nondiabetic and diabetic patients with acute ischemic stroke

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Keywords
Hemoglobin A1c; Stroke; Prognosis

Abstract

Background: Diabetes is a well-known risk factor for acute ischemic stroke (AIS). Some recent studies point to hemoglobin A1c (HbA1c) may have prognostic value in nondiabetic and diabetic patients with ischemic stroke (IS). The aim of this study was to evaluate the prognostic value of HbA1c on mortality and morbidity in AIS patients with and without diabetic.

Methods: In this prospective observational study, 150 diabetic and nondiabetic patients with AIS were evaluated for serum HbA1c level, hypertension (HTN), hyperlipidemia, and smoking in the first 24 hours of admission to determine their value to predict mortality and mortality at 30 and 90 days. Morbidity was estimated by the National Institutes of Health Stroke Scale (NIHSS) and follow-up visits were scheduled 30 and 90 days after admission. Results were analyzed with independent t-test and logistic regression analysis.

Results: In this study, 73 patients (48.7%) were female and the rest were men. At 30 days, the diabetic patients had a significantly higher mortality, but no significant difference was found between diabetics and morbidity. No significant statistical differences were seen between HbA1c and 30 and 90 days with mortality and morbidity among diabetic patients. Furthermore, no significant statistical difference was seen between HbA1c and 30 and 90 days morbidity and between HbA1c and 30 days mortality in nondiabetic patients. However, in nondiabetic patients, on multiple logistic regression analysis, a significant correlation was seen between 90 days month mortality and HbA1c (P = 0.002).

Conclusion: HbA1c can be as a predictive biomarker in nondiabetic patients with AIS.

Introduction

Stroke is one of the most important causes of death in the world. It is the second cause of mortality in many countries. The frequency of acute ischemic stroke (AIS) is about 75%.[1] Diabetes are one of the main risk factors for AIS[2] and has repeatedly shown a negative effect of exacerbating ischemic brain injury, accelerating the molecular processes leading to cell death, and resulting finally in larger infarct volumes and poorer outcomes.[3,4] It seems that the effect of diabetes on stroke is mainly due to atherosclerosis or induction of an inflammatory reaction which is

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possibly reversible with treatment.[4,5] Some studies show that some blood sugar related biomarkers, such as fasting blood sugar or random blood sugar, can be used as prognostic tools in ischemic stroke (IS) patients.[6-9] Hemoglobin A1c (HbA1c) is the form of Hb. It is measured to estimate the average plasma glucose concentration over 2-3-month period. Some recent studies suggest that HbA1c may have prognostic value in patients with AIS.[10] For example, in an Irish study, in 165 patients who underwent surgery for vascular disorders, the rate of 1-month mortality was significantly higher in nondiabetic and diabetic patients with abnormal HbA1c level.[9] Another study on diabetic and nondiabetic patients with abnormal HbA1c level showed higher carotid artery stenosis in patients with abnormal HbA1c.[11] In other studies in China on patients with AIS, the severity of stroke was higher in patients with abnormal HbA1c.[12,13] Despite above-mentioned studies, a study in Korea on diabetic patients showed a correlation between HbA1c level and severity of stroke, but this relationship was not seen in nondiabetic patients.[14] According to these controversies and lack of a final conclusion, this study aimed to evaluate serum HbA1c level and its prognostic value in nondiabetic and diabetic patients with IS.

Materials and Methods

Our prospective observational study was performed on 150 patients with AIS in Kerman. Patients suffered from IS for the first time and were admitted within first 24 hours of onset of symptoms. Diagnosis of IS was based on computed tomography-scan and magnetic resonance imaging (DWI, T1, and T2) findings. A cardiologist visited all patients, and the patients underwent transthoracic echocardiography and electrocardiography monitoring for 24 hours. In the case of clinical suspicion, transesophageal echo was done and cardioembolic stroke was excluded. The patients with any underlying diseases other than diabetes and hypertension (HTN) were excluded from the study. Those who took medications (except drugs for diabetes, HTN, and hyperlipidemia) were also excluded. Furthermore, patients with any laboratory abnormalities such as elevated erythrocyte sedimentation rate were excluded from our study. In this study, those patients undergoing drug therapy or having systolic blood pressure higher than 140 or diastolic higher than 90 mmHg were considered as having HTN. Patients were also treated diabetic who were under drug therapy or had fasting blood glucose > 126 mg/ml or random blood sugar over 200 mg/dl with the symptoms of diabetes. Those who used five cigarettes/day were regarded as smokers. HbA1c was measured within the first 24-hour of admission by chromatography and HbA1c level > 6.5 ug/ml was considered as abnormal in nondiabetic patients. In addition, HbA1c level < 7 ml was regarded as good control (normal) in diabetic patients.[15,16] The National Institutes of Health Stroke Scale (NIHSS) score was assessed on admission and 30 and 90 days to get morbidity assessment. The patients fallowed for 90 days or death. For every patient, a questionnaire containing demographic information and NIHSS was provided, and patients were divided into two groups according to diabetes. Power of study was 80% and $P \leq 0.050$ was considered statistically significant. Demographic information and other findings were analyzed using independent t-test and logistic regression. Our study was approved by the Ethics Committee of Kerman University of Medical Sciences.

Results

In this study, 73 (48.7%) and 77 (51.3%) patients were female and male, respectively. Table 1 shows baseline characteristics data of the patients. The mean HbA1c in diabetic and nondiabetic patients were 7.72 ± 2.20 and 5.68 ± 1.22, respectively.

Table 1. Baseline characteristics data of the patients

Characteristics	Value
Age (year) (mean ± SD)	71.18 ± 9.10
Gender [n (%)]	
Female	73 (48.7)
Male	77 (51.3)
History of HTN [n (%)]	
Yes	100 (66.7)
No	50 (33.3)
History of diabetes [n (%)]	
Yes	46 (30.7)
No	104 (69.3)
History of smoking [n (%)]	
Yes	56 (73.3)
No	94 (62.7)
History of hyperlipidemia [n (%)]	
Yes	57 (38.0)
No	93 (62.0)
Level of HbA1c (mean ± SD)	6.31 ± 1.84
30 days mortality [n (%)]	32 (21.3)
90 days mortality [n (%)]	8 (5.3)

SD: Standard deviation; HTN: Hypertension; HbA1c: Hemoglobin A1c

Table 2. Comparison of morbidity among diabetic and nondiabetic patients

Time	Diabetic patients (mean ± SD)	Nondiabetic patients (mean ± SD)	P
Admission time morbidity	10.42 ± 1.09	8.37 ± 0.55	0.101
30 days morbidity	5.86 ± 0.72	5.53 ± 0.57	0.753
90 days morbidity	5.55 ± 0.76	4.79 ± 5.03	0.472

SD: Standard deviation

At 30 days, patients with diabetic had a significantly higher mortality (P = 0.040), but there was no significant difference between diabetes and morbidity (Tables 2 and 3). There was no significant statistical difference between HbA1c and 30, and 90 days with mortality and morbidity among diabetic patients. Furthermore, there was no significant statistical difference between HbA1c and 30, and 90 days morbidity and between HbA1c and 30 days mortality in nondiabetic patients. However, in nondiabetic patients, on multiple logistic regression analysis, a significant correlation was seen between 90 days month mortality and HbA1c (P = 0.002) (Table 4). Regarding insignificant difference in NIHSS on admission in dead and alive nondiabetic patients (P = 0.890), it can be concluded that HbA1c is a prognostic biomarker in nondiabetic patients.

Discussion

In stroke, reliable prognostic markers are very important because they can aid clinical decision-making and help to health-care resources. The aim of our study was to evaluate the prognostic value of HbA1c in non-diabetic and diabetic patients with AIS. Our findings showed no significant difference in HbA1c level on admission with 30 and 90 days mortality and morbidity in diabetic patients, and with 30 and 90 days morbidity and 30 days mortality in nondiabetic patients. However, our findings showed a significant correlation between 90 days mortality in non-diabetic patients and HbA1c after adjustment for risk factors by logistic regression analysis (P = 0.002). Then, it can be concluded that HbA1c can be used as a prognostic biomarker in nondiabetic patients with AIS. This result was agreement with some previous studies. For example, Roquer et al.[16] aimed to evaluate the effect of HbA1c and glucose level on 3-month mortality predilection in nondiabetic and diabetic IS patients. They found HbA1c determination combined with first measured glucose value is useful to stratify mortality risk in AIS patients.[16] Hjalmarsson et al.[17] in a retrospective study on 501 patients with AIS observed a correlation between HbA1c and mortality and also permanent complications in nondiabetic patients, as same as diabetic patients. Guo et al.[13] in another study evaluated HbA1c in 180 patients IS within the first 24-hour of stroke. They divided the patients into three groups based on HbA1c level (6.5 > HbA1c > 5.7, HbA1c < 5.5, and HbA1c < 6.5). They evaluated them at the admission time and 3-month after stroke by NIHSS. Their study showed that IS prognosis depends on different HbA1c levels. The patients with higher HbA1c level had poorer neurological condition and prognosis in the first 3 months after stroke.[13] Some studies show that HbA1c was associated with greater carotid stenosis and periventricular ischemic lesions.[18-20] Studies even suggest that HbA1c abnormality is associated with poorer thrombolytic therapy response.[21] In contrast to our and above studies, there is few research that rejects such relationship, including the research in Korea. In this study, 639 stroke patients were evaluated. No relationship was found between HbA1c and any type of cerebrovascular lesion in the nondiabetic patients.[14] We did not observe any relationship of HbA1c with mortality and complications in diabetic patients. This finding disagrees with some studies.[22,23] Regardless of whether it may be an incidental finding, some factors may be involved in this discrepancy. First, the mean age of our patients was low. Second, all types of stroke were included but their frequencies were unknown. It is evident that high frequency of lacunar affects prognosis. In this study, 30.7% of patients were diagnosed with diabetes, which is within the world range. World statistics report its frequency between 15% and 44%. Such discrepancies may be attributed to some factors such as population study and definition of diabetes.[15]

Table 3. Comparison of mortality among diabetic and nondiabetic patients

Time	Diabetic patients [n (%)]	Non-diabetic patients [n (%)]	Total [n (%)]	P
30 days mortality	14 (30.4)	18 (17.3)	31 (21.3)	0.040
90 days mortality	2 (4.3)	6 (5.8)	8 (5.3)	0.721

Table 4. The relation between mortality and evaluated variables

Variables	Crude coefficients			Adjusted coefficients		
	B	Adjusted odd ratio	P	B	Adjusted odd ratio	P
Age	0.129	1.13	0.006	0.086	1.090	0.018
Gender	0	1.00	> 0.999	-0.570	0.566	0.359
HTN history	-0.077	0.46	0.302	-0.411	0.663	0.520
Smoking history	0.031	1.03	0.551	-0.230	0.794	0.709
HbA1c Hb	0.081	1.08	0.567	0.822	2.270	0.002
Hyperlipidemia history	-1.190	0.30	0.069	0.624	0.536	0.295

HTN: Hypertension; HbA1c: Hemoglobin A1c

The main limitation of this study was relatively short follow-up period. Obviously, if the follow-up period becomes longer in future studies, the results will be more valuable. In conclusion, our findings show that HbA1c can be a predictive biomarker for mortality among nondiabetic patients with AIS.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Original Paper

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Association of insulin-like growth factor-I with the severity and outcomes of acute ischemic stroke

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Keywords
Acute Ischemic Stroke; Insulin-like Growth Factor-I; Outcome; Severity

Abstract

Background: The aim of this study was to evaluate whether higher serum levels of insulin-like growth factor-I (IGF-I) in the acute phase of ischemic stroke are associated with less severe strokes and better functional outcome in a period of 12-month follow-up.

Methods: From October 2014 to August 2015, patients with the diagnosis of acute ischemic stroke admitted to the stroke unit of Firoozgar Hospital, Tehran, Iran, entered this prospective study. National Institutes of Health Stroke Scale (NIHSS) and Modified Rankin Scale (MRS) for stroke scores were used to measure the severity and outcomes of an acute ischemic stroke at the time of admission and 1 year after the stroke, respectively.

Results: A total of 60 acute ischemic stroke patients (28 male, 32 female) with the mean age of 71.1 ± 9.0 years were evaluated for the serum level of IGF-I at the time of admission to the stroke unit of Firoozgar Hospital. There was seen a significant correlation between the IGF-I serum level and the MRS scores (P = 0.020; correlation coefficient = −0.32). IGF-I serum level had no significant correlation with NIHSS scores.

Conclusion: These results support that the higher serum levels of IGF-I at the time of stroke is associated with a significant better outcome in a 1-year period of follow-up. However, this hormone serum level seems not to have a predictable value for the ischemic stroke severity. Further studies are required to clarify the neuroprotective mechanisms of IGF-I in ischemic stroke process.

Introduction

Cerebrovascular accidents had a great outbreak in human society that can lead to severe disability and reduced quality of life.[1] Ischemic stroke is defined as a loss of brain function due to deficiency in the blood supply caused by arterial embolism or thrombosis.[2] In Western countries, stroke is the most common cause of death after heart diseases and before cancers.[3] Although reperfusion by tissue plasminogen activator (tPA) is the approved acute treatment of ischemic stroke, a very small proportion of patients benefits it due to strict inclusion criteria and the limited time for treatment.[4]

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Insulin growth factor-I (IGF-I), a hormone with high molecular similarity to insulin, is known to be important in childhood growth and has anabolic effects in adults.[5,6] Animal model studies reported IGF-I to play an essential role in the process of brain development.[7] IGF-I is also capable to influence neuronal growth, excitability and release of the neurotransmitters.[8] It is an endogenous factor for neurons survival, glial and endothelial cells and may enhance functional recovery after injury by stimulating the precursors of neural and oligodendrocyte to proliferate.[9]

Protective effect of this hormone in preventing nerve damages has been demonstrated in cultured neuronal cells,[10,11] and the positive effect of exogenous administration of IGF-I in neurogenesis have been shown in mouse brain.[12,13] This hormone is also effective in the survival of both motor and sensory neural cells.[14] It has an effect in regulating neural development including neurogenesis, myelination, synaptogenesis, and dendritic branching after neuronal damage.[15] IGF-I has been reported as a potent neuroprotective compound ischemic stroke studies of rodent models.[16] A small study in elderly patients with stroke found an inverse relation between circulating IGF-I levels, determined within 24 hours of admission, and the outcome, mainly death.[17] A relationship between improvement in functional and cognitive scores in revalidating stroke patients and higher IGF-I serum levels is also reported.[18] IGF-I serum level has been reported to increase after treatment with tPA to 70% in stroke patients.[19] Specific transport across the blood brain barrier has been reported for IGF-I[20] and due its disruption after cerebral ischemia[21] may support the hypothesis that systemic IGF-I could be considered as a new treatment goal in acute phase of stroke.

A review by Kooijman et al.[16] showed IGF-I to be neuroprotective in animal models of cerebral ischemia. Epidemiologic studies on human populations reported a higher rate of mortality in acute ischemic stroke patients in association with lower IGF-I serum levels[6,17,22-24] and lower serum levels of IGF-I in patients with ischemic and hemorrhagic stroke is in relationship with 1.5 and 5.2 times more mortality rate, respectively.[25] Some studies have shown that exogenous IGF-I reduces neurological damage and neural defects in the acute phase after cerebral ischemic stroke within 24 hours to 7 days.[26,27]

This cross-sectional study was designed to evaluate the effect of IGF-I serum level at the acute phase of stroke in the severity and outcome of the patients in a 12-month follow-up.

Materials and Methods

The Local Ethics Committee of Firoozgar Clinical Research Development Center has approved this study. Informed consent was taken from the patients before collecting blood samples. The information of patients remained confidential and used only for research purposes.

Acute ischemic stroke patients admitted to the stroke unit of Firoozgar Hospital, Tehran, Iran, from October 2014 to August 2015 entered this prospective study. Stroke patients admitted with any of the following criteria were excluded from the study: age < 50, hemorrhagic stroke, previous brain trauma, insulin dependent diabetes, liver or kidney failures, Infectious disease, receiving any treatment that would affect growth hormone-IGF-I axis. The blood sample of the included patients was collected to evaluate the serum IGF-I levels (ng/ml) at the acute phase of stroke. IGF-I serum level was assayed with the method of chemiluminescence immunoassay after acid-ethanol extraction in the laboratory of Firoozgar Hospital during the first 24 hours after the ischemic stroke.

To measure the severity and outcomes of acute ischemic stroke at the time of admission and 1 year after the stroke, the National Institutes of Health Stroke Scale (NIHSS) and Modified Rankin Scale (MRS) scores were used by an expert neurologist, respectively. NIHSS objectively quantify the severity and impairment caused by stroke based on clinical symptoms and disorders.[5,28] While MRS determines the degree of dependence or disability caused by stroke.[29,30]

The collected data were analyzed by SPSS software (SPSS Icn., Chicago, IL, USA). Only those patients were included in the final analysis that completed the 1-year follow-up. To investigate IGF-I serum levels changes in all patients and for each group repeated measurement ANOVA test and post-hoc were used. Independent t-test, one-way ANOVA and chi-square were also used to compare qualitative and quantitative variables between groups. $P < 0.005$ was considered statistically significant.

Results

A total of 60 patients with the mean age of

Table 1. Categorization of the patients according to their IGF-I serum levels and MRS scores

MRS	Number of patients (%)	Mean ± SD (ng/ml)
No symptoms	10 (16.6)	234 ± 218
No significant disability: Able to carry out all usual activities, despite some symptoms	6 (10.0)	140 ± 18
Slight disability: Able to look after own affairs without assistance, but unable to carry out all previous activities	3 (5.0)	204 ± 230
Moderate disability: Requires some help, but able to walk unassisted	5 (8.3)	130 ± 74
Moderately severe disability: Unable to attend to own bodily needs without assistance, and unable to walk unassisted	13 (21.6)	128 ± 106
Severe disability: Requires constant nursing care and attention, bedridden, incontinent	5 (8.3)	45 ± 27
Dead	18 (30.0)	117 ± 115

MRS: Modified Rankin Scale; IGF-I: Insulin-like growth factor-I; SD: Standard deviation

1.71 ± 9.0 years completed the 1-year follow-up and entered this cross-sectional study. 28 patients were male (46.7%), and 32 patients were female (53.3%). At the time of admission, the mean of IGF-I hormone serum levels was 110.0 ± 119.5 (ng/ml). Table 1 shows the categorization of the patients according to their IGF-I serum levels and MRS scores. There was seen a significant correlation between the IGF-I serum level and the MRS scores (P = 0.025; correlation coefficient = −0.329). While no significant correlation was found between the IGF-I serum level and NIHSS score (P = 0.346; correlation coefficient = 0.058).

Discussion

This study shows that in 12-month follow-up, higher serum levels of IGF-I in the acute phase of ischemic stroke was associated with a better outcome in a group of 60 patients. However, it no association was found with the stroke severity. In the study by de Smedt et al., the association between IGF-I serum levels in 255 patients with ischemic stroke was evaluated with the outcomes and severity of stroke. In this study, we used NIHSS and MRS to define the progression and the severity of the stroke at the time of admission and 3 months later. After controlling the confounding factors, it has been shown that patients with higher IGF-I and IGF binding protein-3 serum levels within 6 hours of stroke had better functional and neurological outcomes 3 months later. In this study just like ours, stroke severity was not significantly associated with IGF-I serum levels and the authors concluded that better improvement after cerebral ischemic stroke is in association with the higher IGF-I serum levels.[9] Bondanelli et al.[18] studied 42 patients during rehabilitation after ischemic stroke to evaluate the relationship between serum levels of IGF-I with stroke severity and outcome. NIHSS was used to define the severity of stroke in this study and MRS, functional independence measure (FIM), and Los Amigos Cognitive Functioning Scale (LCFS) were used to determine the stroke progression. Similar to our findings, no significant association was reported between the ischemic brain damage severity caused by stroke and the IGF-I serum levels. While, using LCFS, FIM and MRS scores showed statistically better outcomes in patients with IGF-I serum levels more than 161.8 (μg/dl). This study also examined the adrenocorticotropic hormone, luteinizing hormone, follicle-stimulating hormone, and prolactin levels that showed no significant relationship with FIM and LCFS scales. Authors suggested that higher serum levels of IGF-I are associated with better recovery and better cognitive performance after cerebral ischemic stroke, which emphasizes the protective effect of this hormone for the nervous system. Our findings are also in consistency with the study by Denti et al.[17] in which low levels of IGF-I were introduced in relation with worse neurologic function in 88 elderly patients 3 months after the stroke. In comparison to the control group, the mean of IGF-I serum levels was lower in ischemic stroke patients in this study. In addition, lower IGF-I levels were in correlation with poor outcomes. This study suggests IGF-I as a predictor of the stroke outcome in elderly patients. In a very important case–control study with more than 57000 patients and a 5-year period of follow-up, Johnsen et al.[6] reported a 2-fold

increased risk of ischemic stroke in patients in bottom quartile of IGF-I serum levels compared with those in the upper quartile. This valuable finding can support the hypothesis of the IGF axis involvement in the pathogenesis of ischemic stroke.

Some limitations of this study should be taking into consideration. First, generalizability of the results of our study is limited by small sample size; however, the same findings are noticed in almost all similar studies. On the other hand, MRS may be assumed as an insensitive measure of functional outcome and more accurate objective outcome measures may be used for further studies. On the other hand, it might be better to report the correlation between IGF-1 and 3-month and/or 6-month outcomes in addition to 1 year follow-up.

Conclusion

This study was however the first of its kind in Iranian population. From the findings of this study and comparison with other similar studies, we can consider that there may strongly be an association between neurological function outcome after the acute ischemic stroke and IGF-I serum levels. Although, this hormone seems not to be associated with the severity of cerebral ischemic stroke. This study recommends the probable effect of IGF-1 administration on stroke outcome. Further randomized control trials are required to assess the effect of IGF-1 administration on stroke outcome in addition to the neuroprotective mechanisms of this hormone.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Review Article

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The impact of Kinesio taping technique on children with cerebral palsy

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Keywords
Balance; Cerebral Palsy; Hand Function; Kinesio Taping; Motor Function

Abstract
Cerebral palsy (CP) is the most common movement disorder in children that is associated with life-long disability and multiple impairments. The clinical manifestations of CP vary among children. CP is accompanied by a wide range of problems and has a broad spectrum. Children with CP demonstrate poor fine and dross motor function due to psychomotor disturbances. Early rehabilitation programs are essential for children with CP and should be appropriate for the age and functional condition of the patients. Kinesio taping (KT) technique is a relatively new technique applied in rehabilitation programs of CP. This article reviews the effects of KT techniques on improving motor skills in children with CP. In this study, we used keywords "cerebral palsy, Kinesio Tape, KT and Taping" in the national and international electronic databases between 1999 and 2016. Out of the 43 articles obtained, 21 studies met the inclusion criteria. There are several different applications about KT technique in children with CP. Review of the literature demonstrated that the impact of this technique on gross and fine motor function and dynamic activities is more effective than postural and static activities. Also this technique has more effectiveness in the child at higher developmental and motor stages. The majority of consistent findings showed that KT technique as part of a multimodal therapy program can be effective in the rehabilitation of children with CP to improve motor function and dynamic activities especially in higher developmental and motor stages.

Introduction

Cerebral palsy (CP) is a neurological non-progressive disorder resulting from brain damage occurring before, during, or after birth[1,2] along with permanent disorder of movement and posture.[3] It is the most common movement disorder associated with lifelong disability and motor deficit.[4] The topographic classification of CP is hemiplegia, diplegia, and quadriplegia. Another classification is based on motor function as pyramidal (spastic) and extrapyramidal (non-spastic including athetoid, ataxic, and

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dystonic). The prevalence of CP is about 2 to 2.5 per 1000 live births.[3,5] According to the International Classification of Functioning system (ICF), CP affects the body structures (e.g. limbs), body function (e.g. intellectual function), activities (e.g. standing/walking), and participation (e.g. sport). These deficits subsequently lead to some disabilities including impairments, limitation in function, and restriction in participation.[6] Psychomotor disturbances in children with CP results in limitation in use of the limbs, more paralysis, difficulty in performing activities of daily living (ADL), more dependence and ultimately lower quality of life. Therefore, it is essential that the treatment be provided early and effectively.[7,8] A variety of commonly therapeutic options are used for CP treatment including botulinum toxin injection,[9] orthopedic surgery, Constraint-induced Movement Therapy (CIMT),[10] oral medications,[10] occupational and physical therapy.[11-14] The aim of occupational and physical therapy in the treatment of children with CP is to normalize the muscle tone, reduce the muscle and joint contractures and improve the sensory and cognitive problems, improve muscles strength, increase the range of motion (ROM) and fostering children's independence level in ADL[15-17] by means of a number of various dynamic approaches including Bobath,[18] Sensory Integration (SI), proprioceptive neuromuscular facilitation (PNF)[19] and the Brunnstrom techniques.[3,18] Kinesio taping (KT) is a relatively new therapeutic tool used in rehabilitation program of children with cerebral palsy, although it has been used for a long time in sport or orthopedic fields, and has been approved as a supplemental intervention for other functional impairments.[20-23] Kinesio tape is a specialized elastic-like tape made of latex-free cotton fibers having no medication effect[24] and designed to mimic the elasticity properties of the muscle, skin and fascia.[23] By proper taping, the elasticity of the tape not only does not restrict the soft tissue, but also supports the weak muscles and creates a full ROM. It has been hypothesized that KT may favorably stimulate the coetaneous receptors of the peripheral sensorimotor system, since these receptors are associated with pain, proprioception and motor control.[25] Taping can influence the skin, lymphatic system, circulatory system, fascia, muscle and joint[26] and theoretically leads to enhancing proprioception,[27] diminishing pain and edema, reducing muscle spasms, and strengthening the muscles.[28,29] KT supports the joints by correcting the muscle function, restoring the proprioception, optimizing the postural alignment and stimulating the coetaneous receptors. It can reduce the pain and provide the proprioception feedback for reaching and maintaining the natural body posture as well.[30-33] KT application, in conjunction with other regular rehabilitation programs for the children with CP, may positively influence the sensorimotor system resulting in improved voluntary control and coordination of the upper-limbs.[21,31,32] Given the above evidences and the importance of the treatment in children with CP, in addition to investigating KT as a new therapeutic intervention, the main purpose of this study is to have a review in order to evaluate the effectiveness of KT in neurorehabilitation of the children with CP. Another purpose of the present study is to collect the existing literature dealing with Kinesio tape in a single article, to analyze the results and finally to reach the overall conclusion.

Materials and Methods

Nine electronic databases were searched: PubMed, Google Scholar, Science Direct, Ovid, Scopus, Proquest, Web of Knowledge, CINAHL and Islamic World Science Citation Center (ISC) from earliest records to December 2015. Existing systematic reviews and major publications on KT Technique in children with CP were sourced to identify appropriate search terms. Search terms included 'CP', 'taping', 'Kinesio tape', and 'KT'. The references of the papers were also manually searched in order to identify the other potentially eligible studies. An initial review was undertaken of all titles and abstracts. All articles considered appropriate were read in full to establish if they met the eligibility criteria. Inclusion criteria were: 1) the availability of abstract or full text of the articles; 2) the studies were merely conducted on CP and KT. Studies were excluded if children with CP had received botulinum toxin injection prior to the intervention or as part of the treatment or comparative therapy.

Results

A flow chart of the selection process is shown in figure 1. After conducting the searches based on the inclusion and exclusion criteria, a total number of 37 articles were collected; out of which 21 articles, including 14 full text articles and 7 abstracts, fulfilled the inclusion criteria. Among

the 21 selected articles conducted on the effects of KT in the children with CP; eight studies were conducted on the hand and upper-limb, six studies on the lower limb, five studies on the trunk and vertebral column, one study performed on drooling and only one was a commentary article. A summary of all articles included in this review can be found in table 1.

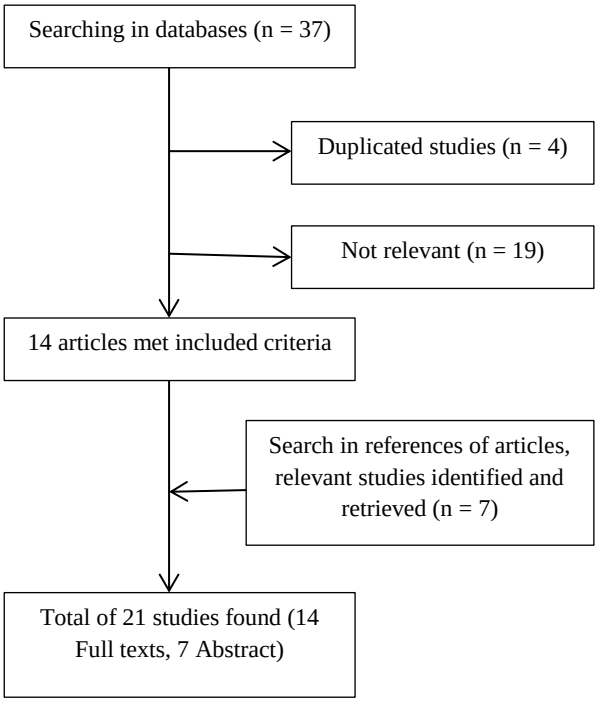

Figure 1. Flowchart of study identification

Discussion

According to the reviewed papers, we have found that KT can be used in rehabilitation in combination with other common therapeutic techniques including: increasing of strength, enhancement of endurance, improving ROM, and reduction of spasticity. For a better understanding; papers were examined in three following sections:

Hand and upper extremity

The results of all studies that investigated the effectiveness of KT on the hands and upper extremity were significantly positive; and the authors concluded that KT technique could be effective for improving the upper extremity motor skills in the children with CP. In the articles reviewed, the purposes of KT application on the upper-limb were: 1) positioning of the wrist, palm, and thumb in the functional position (opening the hand to sensorial stimulate and improve the function of the thumb and other fingers);[12,34-38] 2) reducing the spasticity;[38] 3) forearm supination;[12] 4) maintaining the shoulder in a functional position;[34] and 5) promote active ROM of wrist and fingers.[35,36,39] In all relevant papers, the authors have described the benefits of using KT, although Keklicek et al.[37] believed that no direct correlation exists between the spasticity and the functional ability, and the improvement in Modified Ashworth Scale does not necessarily leads to a more functional use of the upper-limb. The results of the identified literature shows that KT applied in hand and upper-limb may result in enhancing the motor function, timing, speed and smoothness of the movement, active ROM, dexterity, grasp and release as well the spasticity reduction, but it has no effect on weight bearing and protective extension in children suffering from spastic diplegic CP.[12,34,37,38] Tape can promote wrist active ROM; whatever, in studies of Demirel and Tunay[36] and Bahadir Agce et al.[39] these change were significant, but in study of Chitaria et al.[35] these were not significant; variances in results could be due to differences in intervention period of these studies.

Trunk/lower extremity

In the studies that investigated the effect of KT on gross motor skills and functional abilities in trunk and lower extremity, it was applied on ankle (in order to reduce spasticity of Achilles and increase the strength of the tibialis anterior), back of the knee (controlling the genus recurvatum), para spinal muscles, and quadriceps muscles. In the published studies conducted on the lower extremity, improvement in gross motor function, dynamic activities, trunk and posture control, and muscle balance in sitting and standing position were reported.[32,33,35,36,39,41] Conversely, da Costa et al.[30] found no direct effect in the static activities after using KT. Also despite improving in motor skills, Iosa et al.[40] did not find any change in the modified Ashworth scale and equinus foot. The results revealed that KT is an effective method in dynamics activities, like sit-to-stand, walking and movement patterns, improving in ADL and ROM, and spasticity reduction,[30,33,40-42] but not effective in static balance and static postural control.[30] Moreover, no significant changes were found in GMFM score and sitting posture of quadriplegic children at levels 4 and 5 of GMFCs scale.[41]

Table 1. A summary of the examined articles (the arrangement based on taping area and the articles full text or the abstracts)

Author	Objectives	Type of study	Sample size	Age (year)	Area taped	Outcome measure	Intervention period	Results
Chitaria et al.[35]	Evaluate short-term effects of KT on fine motor function and active wrist extension ROM in CP	Quasi-experimental	15	3-6	Lateral epicondyle of the humerus to dorsal aspect of metacarpal head	PDMS-2, Video recording (for AROM)	3 days	Significant changes were found in fine motor. AROM of wrist extension changed but these were not significant.
Keklicek et al.[37]	To investigate the effect of tape application on thenar, palmar and upper limb of children with CP	RCT	45	4-14	Extensor surface of the thumb and first web space	NHPT, NPPT	20 Minutes	Significant difference between groups and positive effect of KT on the hand function.
Demirel and Tunay[36]	Determine effect of Kinesio tape on active ROM of the wrist	Pilot study	15	6-18	Extensor muscle of wrist	Goniometer	45 minute	Statistically significant changes were found in wrist extension, radial, ulnar deviation AROM and wrist extension ROM while functional ball grasping.
Camerota et al.[34]	To investigate the influence of NMT on the upper limb in a child with left hemiplegia CP	Case study	1	17	Palmar, cervical, anterior & posterior region of shoulder	3D movement analysis	15 days and exchanging the tape each 3 days	Improvement in movement duration, average movement jerkiness, movement speed & smoothness, ROM and less segmented movement.
Sadeghi Moghaddam et al.[38]	To study the effects of KT on wrist in spastic diplegic CP	RCT	26	3-6	Extensor surface of wrist	QUEST, MAS	12 days new taping each 3 days	Spasticity reduction, improvement in grasps and dissociated movements of fingers; no significant differences were found in weight bearing and protective extension.
Mazzone et al.[12]	To assess the effectiveness of KT applied to upper-limb of Hemiplegic CP	Pilot study	16	3 ± 2	Thumb (for extension), forearm (for supination)	Melbourne	17 Months (7 months in the middle of the protocol without taping)	Eight out of the 16 participants completed the entire protocol. Significant difference in the result of all participants.
Bahadir et al.[39]	Analyse the effect of wrist correction Kinesio tape on hand span in CP	Experimental	7	6.78 ± 2.7	Dorsum aspect of wrist and finger	Goniometer	Immediate	Wrist extension angle significantly increased after application.
Demirel[51]	To study KT effects on grasping and release	Experimental	25	Mean: 10	The palm, the first web space, and dorsum of the hands	MACS, MAS	-	Positive result in all variables test.
Ibrahim[44]	Investigate the effect of Kinesio tape on the trunk in spastic diplegic CP	RCT	30	7-10	erector spine muscles from S1 to C7	GMFM-88, PBBS, Formetric instrumentation system	12 weeks (changing tape every 3 days with a day break)	Sitting control, postural parameters, standing control and balance were significantly changed in both groups; but treatment group was more significantly changed than the control group. in pelvic torsion and surface rotation, there were no significant change.

Author	Objectives	Type of study	Sample size	Age (year)	Area taped	Outcome measure	Intervention period	Results
Simsek et al.[33]	To study the effects of KT on sitting posture, gross motor function and functional independence in CP	RCT	31	8 ± 4	Para spinal S1- C7	GMFM, WeeFIM, SAS	12 weeks (changing tape every 3 days with a day break)	Positive effect on sitting posture, no direct effects on gross motor function and functional independence.
Footer[41]	To assess therapeutic taping effectives on dysfunctional sitting and control gross motor function in quadriplegic CP	RCT	18	3-13	Para spinals	GMFM-88	12 weeks	No significant differences were found for the GMFM scores.
Elbasan Uzun Akkaya[46]	Investigate the effects of NMES and KT in addition to NDT, on sitting balance in CP	Crossover, before-after trial	4	5-12	Paravertebral muscles	MMT, GMFCS, GMFM, SPCM, Modified functiona reach, WeeFIM, CP QOL	6 weeks	Significantly change was found in abdominal and trunk extensor muscle strength, GMFM, CP QOL and functional reach test Combination of KT, NMES and NDT is more effective than each one.
Burditt[45]	The effect of KT on dysfunctional sitting control in quadriparesis CP	RCT	18	-	-	EMG, Kinematic, GMFM	12 weeks	Differences in the GMFM and EMG of the Para spinal musculature were NOT significant.
Kaya et al.[50]	To evaluate activity and body function of hemiplegic CP	RCT	30	7-14	Ankle, knee, hip, trunk, shoulder, forearm and wrist	WeeFIM, BOTMP, GMFM, Short-term muscle power	12 weeks (taping 6 days per week)	Positive results in all assessment tests.
da Costa et al.	To assess the immediate effects of KT on STS, balance and dynamic postural control in CP	Pilot study	4	9-11	Quadriceps and tibialis anterior	Motion analysis, PBS, TUG	1 day	Positive results in two tests STS and TUG, no difference in PBS score.
Ghalwash et al.[47]	Investigate the effect of adhesive taping in controlling genu recurvatum in diplegic CP	RCT	14	5-7	Back of the knee (thigh and calf) with x pattern	GMFM-88, Auto-CAD, Screen protractor	12 weeks (changing tape every 60 hours)	No significant changes were found.
Iosa et al.[40]	To promote the developmental motor stage (investigation the KT technique as a non-invasive method) in hemiplegic CP	Experimental	8	Mean: 5	Ankle, knee and hip if necessary	MAS, GMFM, Goniametery, Gait analysis	12 months (the first 6 months physiotherapy alone, and the next 6 months combined with	Function improving (increase in GMFM score and walking speed), improved stability (decrees in the step width and back knee), improving in limb symmetry and movement pattern; no change in Ashworth score, ROM and equines.

KT)

Author	Objectives	Type of study	Sample size	Age (year)	Area taped	Outcome measure	Intervention period	Results
Greve et al.[52]	To reduce the spasticity in diplegic CP	Case study	1	4	Ankle	EMG, ROM, MAS	26 days	Positive change of EMG in tibialis anterior and Triceps Surae, and spasticity reduction in the gastrocnemius.
Iosa et al.[42]	To improve gait hemiplegic CP	Pilot study	2	7 and 10	Ankle	Gait analysis	6 months (wearing the tape 6 days per week)	Gait with normal ankle and less back knee due to reduction in spasticity.
Nieves Estrada et al.[49]	To compare the efficacy of electrical stimulation and KT on drooling in CP	Quasi-experimental	18	-	-	Frequency and severity of drooling	-	Both interventions had equal positive effect.
Iosa[43]	Commentary on the study done by Kaya in 2014	Review	1. KT is an important step in neurorehabilitation program of children with CP 2. KT technique is more effective at levels I, II, GMFM 3. KT in dynamic activities is more effective than static activity 4. KT technique can encourage the children to use their few available resources.					

NMT: Neuromuscular Taping; KT: Kinesio taping; CP: Cerebral palsy; RCT: Randomized control trial; ROM: Range of motion; NDT: Neurodevelopmental treatment; STS: Sit-to-stand

Therefore, KT seems to be more beneficial at the levels 1 and 2 GMFCs and also in dynamic activities. Moreover, taping may encourage less-involved children to use their affected limbs for the maximum ability; however, it is not effective in children with severe involvement. A study revealed that the dynamic activities require more postural control than the static activities,[43] but, in another study KT influenced the dynamic activities while had no effect on the static activities.[30] Ibrahim[44] found that KT significantly improved sitting control, postural parameters, standing control and balance; but in pelvic torsion and surface rotation there were no significant change. Although other studies have examined the effect of KT on trunk and paraspinal muscles, only in one study sitting posture had positive change.[34] In these studies, authors found no significant change in the GMFM score and functional independence.[33,41,45]

In study by Elbasan and Uzun Akkaya[46] that compared the effect of three techniques in three groups (group 1, neurodevelopmental treatment (NDT); group 2, NDT + KT; group 3, NDT + KT + neuromuscular electrical stimulation (NMES), the results showed that the combination of all these modalities (group 3) is more effective on abdominal muscles and trunk extensors, trunk control and posture, functional reach, and ADL that finally led to promotion of quality of life in children with CP and family of them. In a study aimed to promote motor development in children with hemiplegia CP by use of KT on the ankle, authors found the positive influence on the functional skills, walking, symmetrical limbs and locomotor in all participants except one case who also had dyspraxia with SI dysfunction. Therefore, the authors concluded that, in this one exceptional case, it was less likely that child could properly express the increase in the sensory feedback. Furthermore, in spite of the favorable change in functional movements, no significant change occurred in spasticity.[40] This is consistent with of Keklicek et al.[37] finding that showed the spasticity is not directly related to functional ability. Also, these results indicate the opposite effect of the serial casting where gradual reduction in spasticity and ROM increment occurs, without improvement in functional activity.[37,40] Only in one study, the effect of adhesive tape on genu recurvatum in diplegic spastic CP were investigated, but results showed no significant difference.[47] Authors noted that these results may be due to limited ability of tape to overcome the musculoskeletal problem. In this study, value of GMFM was improved that could be attributed to tape's pressure or traction on the skin which provides cutaneous sensory stimulations, so more proprioceptive input passed to the central nervous system. In taping group, joint protection and support provided by the tape could also be another reason of significant improvement in ability of standing and walking.[47]

Others

Drooling is a common problem in children with CP. Cause of these problem is insufficient lip closure and impairment in tongue movements due to diminished sensory perception in oral and perioral.[48] Nieves Estrada et al.[49] compared the effectiveness of KT and NMES techniques on drooling. The results showed that two interventions are equally effective on drooling.

Conclusion

Bearing in mind the results of these studies, especially the considerable results of those by Kaya et al.[50] and Keklicek et al.[37] and Ibrahim,[44] these can be concluded that KT favorably impacts the fine and gross motor abilities and functional independence in ADL, sitting/standing control and balance, etc. Based on these studies, KT is more effective in mild to moderate CP and is not effective in severe CP. Psychological effect of KT can encourage children to fully use their limited ability. The important point about KT is to be used in adjunct with other rehabilitation techniques. This result may influence the therapists' decision to apply KT in neurorehabilitation program for the children with CP. One of the limitations of this study was the small number of relevant published studies. Another limitation was that most of the authors had not mentioned the method of applying KT on the body areas. Therefore, we could not find any relation between the method of taping and the effects of KT. For more accurate results, comparing the effects of this technique with the other rehabilitation techniques in the children with CP, in addition to investigating the efficacy of KT intervention in other neurological diseases, such as stroke, is recommended.

Conflict of Interests

The authors declare no conflict of interest in

this study.

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Short communication

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Anatomical considerations for insertion of pedicular screw in cervicothoracic junction

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Keywords
Cervicothoracic Junction; Pedicle Screws; Dimension; Angulation

Abstract

Background: This study aimed to investigate the pedicle dimension and angulation in cervicothoracic junction (CTJ) using the findings of computed tomographic (CT) to help accurate insertion of pedicular screw.

Methods: Forty three patients with high quality CT images of CTJ were evaluated. Pedicle width (PW), pedicle height (PH), pedicle axis length (PAL), transverse angle (TA) and sagittal angle (SA) were measured bilaterally from C6 to T2.

Results: Mean PW was 5.3 mm at C6, 6.2 mm at C7, 8.1 mm at T1 and 6.5 mm at T2. Males had larger pedicles than females. PH was greater than PW in all vertebrae. SA was relatively constant and around 15 degrees to horizontal plane. There was high variability of vertebral characteristics especially in PAL and TA.

Conclusion: Small diameter screws must be used for pedicular fixation in CTJ. Because of high variability of pedicle morphometry, CT scan is recommended in all patients before instrumentation.

Introduction

Vertebral fixation in cervicothoracic junction (CTJ) is an essential part of treatment in different situations such as trauma, neoplasm, infection and degenerative diseases. Posterior instrumentation systems can provide greater biomechanical stability than anterior constructs in this region. In most cervical vertebrae, using lateral mass screw is the conventional method for posterior fixation but in lower cervical vertebra, lateral masses are small and pedicular screws may be required. However, pedicles of C6 and C7 are small and screw placement desires proper anatomical considerations. Besides, most surgeons use pedicular screw for posterior fixation of T1 and T2 but their pedicles have unique morphology that makes screw placement challenging by conventional techniques.

Different anatomy and relative infrequency with which the CTJ is involved in disease processes makes it a difficult area for spine surgeons to navigate. So, anatomical study of this particular region is of paramount importance to avoid or minimize neural and vascular complications. In this study, we investigated the pedicle dimension and angulation in C6 to T2 vertebrae based on computed tomographic

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findings to help accurate and safe cannulation of the pedicles.

Materials and Methods

Forty three patients who had cervicothoracic spinal multiplanar computed tomography (CT) imaging from August 2012 to December 2014 were evaluated. There were 22 males and 21 females who ranged in age from 22 to 60 years (mean, 38 years). We excluded patients with conditions potentially causing abnormal anatomy, such as previous spine surgery, neoplasm, fracture or spinal dysraphism. Axial CT images were attained with 1-mm slice thickness (Figure 1). Reconstruction into sagittal and coronal planes was then performed to measure various parameters (Figure 1); these parameters were measured bilaterally from C6 to T2.

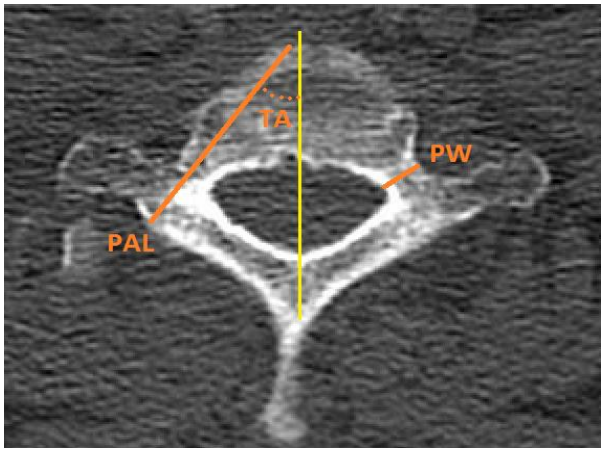

Figure 1. Illustrated method used to measure parameters in axial image
PW: Pedicle width; PAL: Pedicle axis length; TA: Transverse angle

1- Pedicle width (PW): the narrowest outer cortical dimension of the pedicle in an axial plane

2- Pedicle height (PH): superior-inferior diameter of the pedicle isthmus on the sagittal image

3- Pedicle axis length (PAL): the length from the laminar cortex through the center of the pedicle to the anterior wall of the vertebral body; this measurement provides an estimation of the potential screw length.

4- Transverse angle (TA): the angle between PAL and a vertical line from the center of the vertebral body through the center of the spinous process (midline axis)

5- Sagittal angle (SA): the angle between superior endplate and horizontal line in standing lateral cervicothoracic X-ray

Totally, 344 pedicles were measured. Continuous variables were expressed as mean ± standard deviations. Differences of variables were analyzed using t test. Statistical analyses were carried out by the SAS statistical analysis software package (version 9.1, SAS for Windows; SAS Institute, Cary, NC, USA).

Results

Mean and standard deviation of PW, PH, PAL, TA and SA are shown in table 1. Mean PW and PH were not different significantly in left or right side ($P = 0.31$). Pedicular height was higher than PW in all vertebrae ($P < 0.05$).

Mean PW of male patients was 5.3 mm at C6, 6.4 mm at C7, 8.2 mm at T1 and 6.7 mm at T2. Mean PW in female patients was 5.2 mm at C6, 6.0 mm at C7, 8.1 mm at T1 and 6.3 mm at T2. Average PH in the males was 6.9 mm at C6, 7.5 mm at C7, 9.5 mm at T1 and 10.6 mm at T2. In the females, it was 6.8 mm at C6, 7.4 mm at C7, 9.0 mm at T1 and 10.4 mm at T2. Mean PW and PH were larger in males than in females in all four levels which were significant in C7 and T2 for PW and in T1 for PH ($P < 0.05$).

Discussion

Anatomically, the CTJ has varying definitions. We define the CTJ as the superior end plate of the C6 vertebral body to inferior endplate of T2. The lowest two cervical vertebrae especially C7 have small lateral masses and pedicular screws may be required for fixation in many cases.

Table 1. Measurements of pedicular width (PW), pedicular height (PH), pedicular axis length (PAL), transverse angle (TA) and sagittal angle (SA)

Vertebrae	PW (mm) Mean ± SD	PH (mm) Mean ± SD	PAL (mm) Mean ± SD	TA (degree) Mean ± SD	SA (degree) Mean ± SD
C6	5.3 ± 0.9	6.8 ± 0.9	35.0 ± 3.7	42.0 ± 11.0	15.0 ± 2.1
C7	6.2 ± 1.1	7.5 ± 1.3	36.0 ± 4.6	38.0 ± 11.0	17.0 ± 2.1
T1	8.1 ± 1.4	9.2 ± 1.0	37.0 ± 4.3	35.0 ± 7.3	16.0 ± 2.8
T2	6.5 ± 1.0	10.5 ± 1.6	38.0 ± 4.3	22.0 ± 7.2	15.0 ± 3.0

SD: Standard deviation; PW: Pedicle width; PAL: Pedicle axis length; TA: Transverse angle; PH: Pedicular height; SA: Sagittal angle

The first and second thoracic vertebrae have small bodies and their pedicles have more medial trajectory than other thoracic vertebrae; thus conventional methods of pedicular screw insertion in thoracic vertebrae cannot be applied for these two vertebrae.[1] Investigating anatomic parameters of cervicothoracic vertebrae is necessary to avoid misplacement of pedicular screw and neurovascular injuries.[2]

There are numerous publications studying dimensions of cervical and thoracic pedicles. Chazono et al. in their review of published data on cervical pedicle dimension did not find significant ethnic disparity.[3] The mean width of C6 to T1 pedicles in our study was comparable to other studies. Mean PW increased from C6 to T1 and then, decreased in T2. PW in C6 to T1 vertebrae are relatively small and assuming that screw diameter around two thirds of PW, their fixation desires smallest screws available with diameter of 3.5 to 4 millimeters. Otherwise, relatively large screws may result in pedicle wall violation which has been mentioned in many studies.[4-7]

Mean PH increased progressively from C6 to T2. PH was more than width in all of these vertebrae which shows ovoid shape of pedicle cross-section and underscores that mediolateral diameter of pedicle is more concerning during screw placement than superior-inferior diameter.

We observed that the mean PW and PH were larger in males than in females. This finding is similar to other studies.[8,9] The intersex differences in PW and PH indicate that female patients should be given careful attention when considering pedicular fixation.

In addition to pedicular width, the proper angulation of the screw in the axial and sagittal planes is crucial in successful and safe cannulation of the pedicles. SAs of superior endplates in C6 to T2 vertebrae which marks SA of pedicular screws were relatively similar and mild caudal inclination (around 15 degrees) of screw seems appropriate. Transverse angulation of pedicles gradually decreased from C6 to T2 but they often had more medial angulation comparing to other thoracic vertebrae, so usual methods of screw insertion in thoracic spine are not ideal for CTJ.

In parallel to other studies,[10] we found high variability of vertebral characteristics especially pedicular medial angulation and PAL. Therefore, we recommend preoperative CT scan for candidates of instrumentation in CTJ.

Conclusion

Pedicles in CTJ have small width and their fixation desires screws with diameter of 3.5 to 4 mm. Males have larger pedicles than females. Pedicles in CTJ have considerable variation of dimension and angulation; so, CT scan is highly recommended before instrumentation.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Letter to Editor

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Neuromyelitis optica in a pregnant woman with systemic lupus erythematous: A case report

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Keywords
Systemic Lupus Erythematosus; Neuromyelitis Optica; Pregnant Woman

Systemic lupus erythematosus (SLE) is an autoimmune disease which predominantly affects women of childbearing age. Likewise, patients suffering from SLE are at a higher risk of developing other autoimmune diseases.

Neuromyelitis optica (NMO), is a rare inflammatory demyelinating affliction of the central nervous system (CNS) principally characterized by recurrent optic neuritis (ON) and longitudinal extensive transverse myelitis (LETM).[1]

We report a case of a 30-year-old woman at 6 weeks of her second pregnancy with a three-year history of controlled SLE that was subsequently identified to have a NMO.

She had been presenting a dexter paraplegia from inception of pregnancy. Her unexpected numbness primarily had started in both lower extremities (especially right leg) and then, increasingly had progressed to the waist with arthralgia for 5 months. Visual evoked potential (VEP) was performed, by virtue of her complaints of blurred vision and abnormal VEP in both eyes. She had denied headache, dizziness, diplopia, fever and no history of respiratory, urinary and gastrointestinal problems. Moreover, she had a discoid rash on her right cheek.

On physical examination, she was oriented, well-nourished and her cranial nerves were intact. Besides, on musculoskeletal assessment, arthritis symptoms were not recognized though she was slow to perform tasks. She had a revealing enervation in all extremities and her motor strength was at a rate of 2/5. Upper motor neuron dysfunction was suggested according to positive Babinski sign and superficial abdominal

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hyporeflexia.

Routine blood tests and chemistry analysis including complete blood count (CBC), thyroid stimulating hormone and coagulation tests were unremarkable. Autoimmune markers such as rheumatoid factor, lupus anti-coagulant and anti-phospholipid antibodies including anti-cardiolipin and anti-2-glycoprotein were negative but her anti-Sjögren's-syndrome-related antigen-A (anti-SS-A) test, anti-nuclear antibody (ANA) and NMO-IgG test were positive. She had decreased level of serum complement factor; C3 and T4 levels were raised in assessment of thyroid function.

Normal magnetic resonance imaging (MRI) of the brain was seen without plaques. Thoracic cord MRI revealed hyperintense signal lesions from cervical segment 5 to thoracic segment 4 (7 hyperintense demyelinated segments). In addition, hyperintense signal at the thoracic spine level with holocord involvement was seen. According to patient's history (discoid rash), physical examination results (paraplegia), autoimmune tests (positive NMO-IgG) and imaging findings (LETM), a diagnosis of NMO secondary to an acute SLE flair was formed.

The patient was treated with 400 mg of oral hydroxychloroquine once a day for 3 months, and she had no further cutaneous or articular symptoms. At the 8th week of gestation, she had abortion and three pulses of intravenous methyl-prednisolone and daily pulse of cyclophosphamide were administered. Since her condition had not improved after receiving therapy, four sessions of plasmapheresis with 3 liters volume and fresh frozen plasma (FFP) replacement was done. Significant improvement was observed after plasmapheresis, and the patient limb's motility recurred.

SLE is a multisystem autoimmune disease, which its pathophysiology may have consequences on all components of the CNS. The CNS and peripheral nervous systems (PNS) may be involved in SLE. It is well known that NMO is closely linked with other autoimmune diseases; however it has been barely reported in patients with SLE. Our case has an extensive role in justifying the fact that the contact between SLE and NMO can happen during the life span. Mula et al. have hypothesized that early treatment, by combination of plasmapheresis and immunosuppressive agents, may be related to more beneficial conclusion in patients with SLE and longitudinal myelitis (LM).[2] In a similar case report study, a patient with 19 myelitis attacks was reported during rituximab therapy.[3] However, our case experienced one myelitis attack from her NMO onset that substantially improved after plasmapheresis with 6 months follow-up.

From the immunological perspective, cell-mediated immunity converts to increased humoral immunity in normal pregnancy. Pregnancy tends to aggravate NMO and SLE which are B-cell-mediated autoimmune diseases. On the other hand, previous studies declare that NMO-IgG can damage placenta and cause fetal death in mice.[4]

A study reported a case of SLE in 28-year-old women, who diagnosed NMO in the fourth month of her pregnancy. In that case, the patient did not have such a favorable consequence.[5] Therefore, since SLE-associated NMO generally has a poor prognosis and possibly prompting disability and may be the cause to abortion, early diagnosis seems essential.

In conclusion, considering the fact that the incidence of NMO in an underlying autoimmune connective tissue disease represents a co-occurrence of two autoimmune disorders, pregnancy could be suggested as a trigger for this concurrency. Eventually as occurrence of NMO in patients with SLE, especially in pregnancy, is extraordinary, specific researches with collaboration from several groups would be invaluable in order to overcome the limitation of papers such as this one.

Conflict of Interests

The authors declare no conflict of interest in this study.

Acknowledgments

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Letter to Editor

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Treatment of restless legs syndrome/Willis-Ekbom disease with selenium

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Keywords
Restless Leg Syndrome; Selenium; Minerals; Pramipexole

Restless legs syndrome/Willis-Ekbom disease (RLS/WED) is a chronic neurosensory disorder that is characterized by a strong urge to move, accompanied by an uncomfortable paresthesia in the legs which affects about 5-15 percent of adult people in industrialized countries.[1] RLS/WED is a puzzling disease, mostly because of the uncertainty of its etiology. There seems to be a genetic component, but it is also known that RLS/WED may be caused by other underlying pathologies and is treated by remedying those conditions. Another highly researched area in the quest to find an etiology and treatment for RLS/WED is the brain dopamine system; in fact, dopaminergic medication is considered the first line of treatment for RLS/WED that is not caused by other underlying factors.[1]

There is growing evidence, suggesting that selenium plays an important role in many body functions, and seems to be an important regulator of brain function as well.[2] Selenium has a strong anti-oxidant action.[2] The body concentration of selenium is related to soil concentration, which is low in Sweden.

We report the successful treatment of 3 patients with severe RLS/WED with the intake of selenium for 6 months;

Three female patients, aged 25-60 years, were all suffering from severe to very severe RLS/WED since childhood. Severity was measured by using the International Restless Legs Scale (IRLS), a 10-item questionnaire developed by the International Restless Legs Syndrome Study Group (IRLSSG).[1] Each question has five response options, ranging from "0" to "4". Hence, the total score can range from "0" to "40", indicating "no symptoms" to "very severe symptoms", respectively. The subjects' IRLS scores were between 25 and 38. The subject with the IRLS score of 25 was being treated with the dopaminergic drug pramipexole, 0.18 mg in the evening. No one was a smoker, and they were healthy and without any other medical treatment or alternative medicine. Height, weight, blood pressure, hemoglobin, the vitamins folic acid and B12, kidney functions and iron status were within normal limits.

All 3 patients started to take selenium yeast 100 micrograms daily. This was bought over-the-

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counter. No other instructions were given.

Six months later, the patients presented at the clinic and were re-assessed. Their RLS/WED symptoms were substantially reduced to "moderate", represented by their IRLS scores of 10 to 18. The patient who was taking pramipexole had discontinued the intake of the drug. All the patients reported independently from each other that they did not experience any changes initially, but that, after 4 months of treatment, there was a slow and steady reduction of their RLS-related symptoms. None of the patients reported any side effects. The fact, that the patients in this report noticed reduction of their symptoms first after 4 months of treatment would indicate that the placebo efficacy here is lower than expected. Serum-selenium was not recorded among these three patients, but is known to be lower than recommended in this part of the world.

The literature on selenium in RLS/WED is minimal. However, the first and only report in this context, a placebo-controlled trial by Rahimdel et al., showed the RLS/WED symptom-relieving benefits of selenium salt, taken orally, 50 or 200 micrograms per day. The positive outcome was recorded after only one month of treatment.[3]

Interesting in this context is that serum-selenium is low in pregnant women and in patients with end-stage renal disease (ESRD) on hemodialysis,[4,5] two groups of patients known to have with a very high prevalence of RLS/WED.[1] However, there are no data on selenium-status in pregnant women, in patients with ESRD or with other pathologies, who are also suffering from RLS/WED; so, further studies in this context are warranted.

It is possible, at least in theory, that selenium can reduce the symptoms of RLS/WED as it has been proposed that selenium may work on the function of the dopaminergic system.[2] As well, it is known that patients with RLS/WED are under oxidative stress.[1] Thus, given the fact, that selenium is a potent antioxidant, its mechanism of action could be related to its ability to neutralize the reactive intermediates. Another possible working mechanism could be through the positive effect it has on endothelial function.

In order to explore the efficacy of selenium in RLS/WED, future randomized clinical trials would be of great interest and value. Multiple side effects of the dopaminergic drugs, such as emerging problems of augmentation, motivate further research on alternative treatments of this common ailment. If selenium has an efficacy in reducing the symptoms of RLS/WED, future studies might also explore if selenium just compensates for a selenium deficiency in the body or if it has indeed a drug effect.

Conflict of Interests

The authors declare no conflict of interest in this study.

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Neurological Images

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A diagnosis of stroke-like migraine attacks after radiation therapy (SMART) as severe headache with stroke-like presentation

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Keywords
Stroke-Like Migraine Attacks after Radiation Therapy (SMART); Headache; Cranial Irradiation

Introduction

A 52-year-old woman presented to the emergency department with gradual onset headache and expressive dysphasia. She had a left-sided facial droop and an unsteady gait on examination. An immediate non-contrast brain computed tomography (CT) was performed demonstrating evidence of prior right-sided neurosurgical intervention but no acute abnormality to account for her clinical findings (Figure 1). Further enquiry revealed a history of right parietal meningioma resection eleven years earlier followed by adjuvant cranial radiotherapy.

A subsequent brain magnetic resonance imaging (MRI) demonstrated cortical thickening and a gyriform pattern of enhancement at the site of previous resection, with no convincing area of abnormal diffusion restriction (Figure 2, A-C). The patient's symptoms gradually resolved over the course of few months and a repeat MRI brain revealed complete resolution of the previously demonstrated acute findings (Figure 2, D and E).

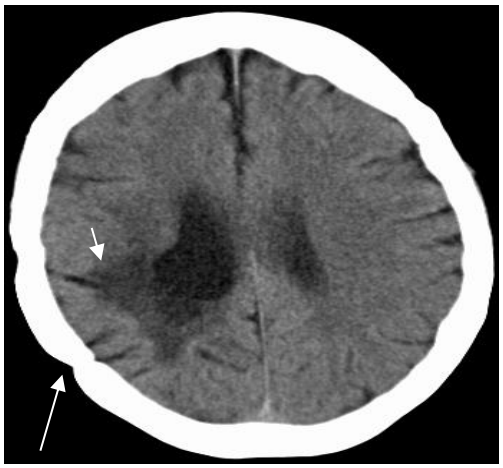

Figure 1. Noncontrast brain computed tomography (CT) demonstrating previous right parietotemporal craniotomy (long arrow) and the underlying encephalomalacia (short arrow)

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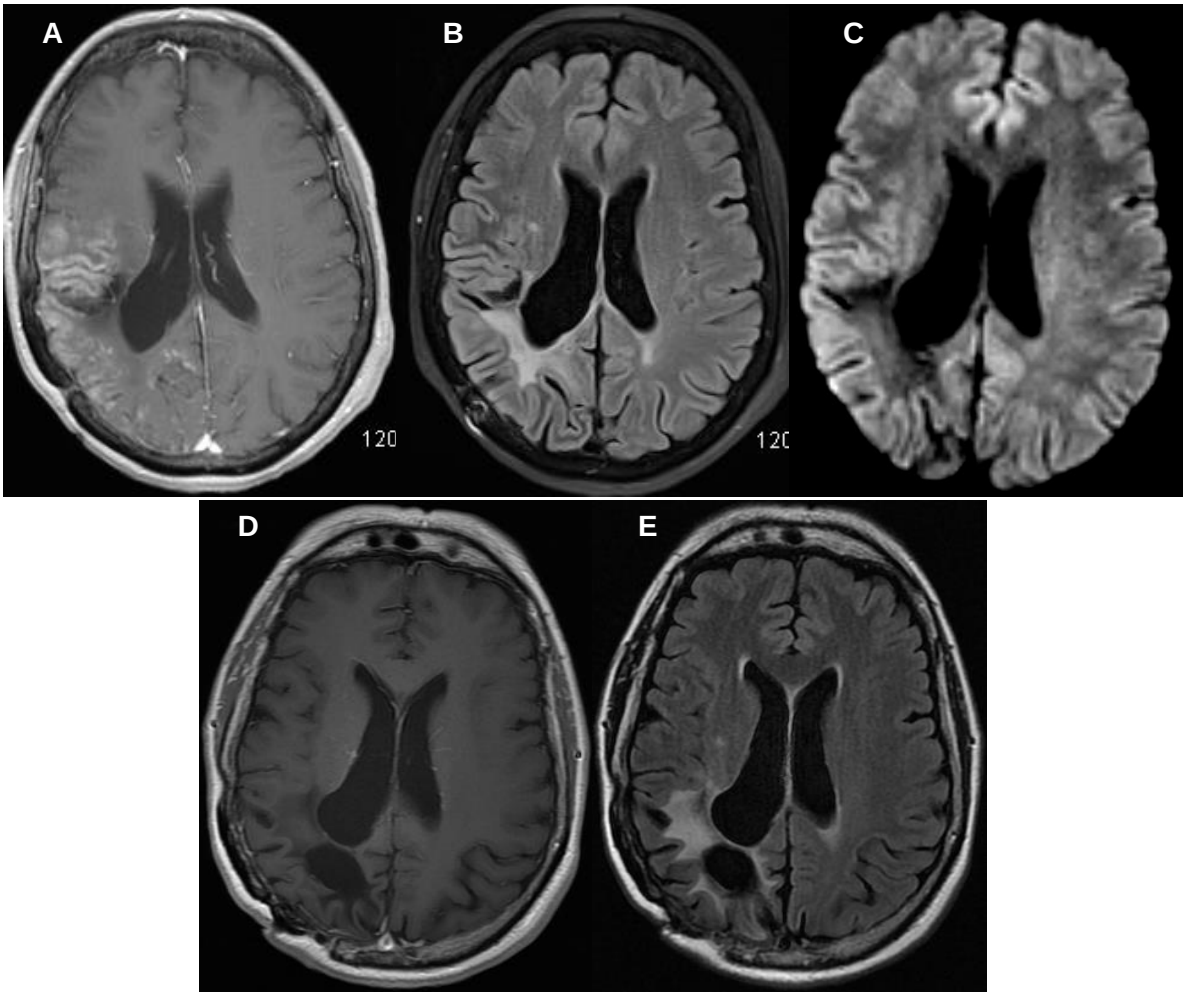

Figure 2. Brain magnetic resonance imaging (MRI): (A) Axial T1-weighted post-contrast, (B) Fluid-attenuated inversion recovery (FLAIR) and (C) Diffusion-weighted imaging showed gyriform enhancement in the right parietal and temporal lobes (thin arrow) with associated gyral swelling overlying the site of previous surgery (thick arrow). (D) T1-weighted post-contrast and (E) FLAIR repeat Imaging 6 month's later, demonstrated complete resolution of the above-mentioned findings.

In view of the clinical presentation of headaches and focal neurological deficits, these image findings in the setting of prior cranial irradiation is characteristic of stroke-like migraine attacks following radiation therapy, also known as SMART syndrome.

SMART syndrome was first described in 1995 and the exact incidence is unknown. It describes a late-onset adverse effect of cranial irradiation, following treatment for a cerebral neoplastic process, usually a malignancy.[1] The clinical features of SMART syndrome are varied but usually consist of migrainous neuralgia with associated symptoms such as nausea and photophobia. Focal neurological deficits such as speech, visual and hearing disturbances, tremor, hemiparesis and hemiplegia have all been described, and seizures are noted in up to 82% of the patients.[2]

SMART syndrome generally shows a self-limiting course without persistent neurological effects, and imaging features resolve in accordance with abating symptomology,[3] with 55% of patients recovered completely over approximately 2 months.[4] However, interestingly, in a retrospective case series by Black et al., it was shown that up to 45% of patients may have persistent neurologic deficits, with approximately 27% of patients demonstrating permanent imaging abnormalities.[4]

Diagnostic investigations in SMART syndrome are centered on the exclusion of other possible etiologies, including tumor recurrence, acute stroke, posterior reversible encephalopathy syndrome (PRES), hemiplegic migraine and cerebral autosomal dominant arteriopathy with

subcortical infarcts and leukoencephalopathy (CADASIL) syndrome.[2] In tumor recurrence, enhancement close to the resection site is intransient and progressive, while in SMART, interval reimaging typically shows resolution of such findings. PRES tends to show bilateral imaging changes, and a family history is usually present in cases of autosomal dominant hemiplegic migraine or CADASIL, both of which can be confirmed by genetic testing.

Unilateral increased T2-weighted signal in the cortex with gyral enhancement that resolves on subsequent imaging typically accompanied by resolution of symptoms distinguishes SMART from these other differential diagnoses.[1] A detailed clinical history, electroencephalography (EEG) and cerebrospinal fluid analysis can help to exclude other entities. In those presenting with seizures, EEG analysis does not usually exhibit an epileptiform pattern,[5] however this is not an absolute finding.[6]

SMART syndrome should be considered in patients previously treated with cranial irradiation who present with headaches and acute neurologic deficits, in conjunction with the characteristic MRI findings above. These typical and usually transient radiological abnormalities help to establish a diagnosis of SMART syndrome, and awareness of this late complication of cranial irradiation can avoid further unnecessary workup.

Conflict of Interests

The authors declare no conflict of interest in this study.

Acknowledgments

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Special Article

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The effectiveness of Orem's self-care program on headache-related disability in migraine patients

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Keywords
Migraine Headache; Orem Self-care Model; MIDAS; Nursing; Iran

Abstract

Background: Providing a self-care program appropriate for patient needs in a supportive educative nursing system format could reduce migraine-induced disability. This study was designed to determine the effectiveness of Orem's self-care program on headache related disability in migraine patients.

Methods: In this randomized clinical trial, episodic migraine patients with or without aura who signed the informed consent were randomly assigned to two groups (44 patients each). The data collection tools included a demographic questionnaire, the Migraine Disability Assessment (MIDAS) questionnaire, an Orem cognition form, and a self-care checklist. The programs were held as four 30 to 45 minutes training sessions for experimental group. The MIDAS were filled out before and three months after program in two groups. Data were analyzed with SPSS statistical software, version 16 and using chi-square, Mann-Whitney and Wilcoxon tests.

Results: There was no statistically significant difference between the two groups in terms of demographic variables ($P > 0.05$). The mean total MIDAS score in the experimental group, before and after the intervention was 28.1 ± 17.5 and 6.03 ± 4.52, respectively ($P = 0.001$); and for the control group, it was 37.6 ± 16.4 and 55.6 ± 14.5, respectively ($P < 0.001$). Also, there was a statistically significant difference in disability indices between the two groups after the intervention ($P < 0.001$).

Conclusion: Self-care program was suitable for needs assessment and provided basis for acquiring positive results in order to decrease disability and saved patient treatment costs.

Introduction

Migraine is a common and disabling neurological disorder with a high prevalence in the first three decades of life.[1-3] Repeated attacks of headache accompanied by nausea and vomiting lead to considerable disability, dysfunction, and lack of recreational and social activities, and inefficiency.[4-6] Migraine induced disability is so severe that the World Health Organization

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(WHO) has listed it among the most disabling diseases.[7-9] Given the unpredictable nature of migraine attacks and their negative effects such as dysfunction, quality of life issues, and family relationships, it could impose serious limitations on the individuals life.[6,7,9,10] Migraine attacks not only influence the patients and their families but also impact the social and economic systems through direct and indirect disabilities.[11,12] Studies have reported all the direct and indirect estimated expenses of migraine to be annually between 14 to 20 billion dollars, a major part of which is related to indirect expenses.[4,13-15] Accordingly, the WHO in their global campaign has introduced measures for reducing the migraine-induced disability as an urgent priority of the public health in order to decrease the burden of migraine.[16,17] Hence, considering the disabling consequences of migraine on social activities, family relationships, and its adverse social and economic consequences and WHO's emphasis on reducing migraine-induced disability, it is important to consider self-care in these patients.[18]

One of the nursing models that is based on the ability of people in their self-care is "Orem's self-care nursing model". Orem describes self-care as practical activities that the individuals perform in order to maintain life, health, and well-being.[19,20] Those who are capable of self-care to satisfy the continuous requirements of maintaining life, health, and well-being are self-care agents. According to Orem, when the self-care agents are not able to satisfy self-care requirements on their own, they need nursing systems to sustain their health status.[21] Orem's self-care nursing model describes nursing systems in three categories: wholly compensatory, partly compensatory, and supportive educative.[22,23] The supportive educative nursing system is applicable for patients with chronic diseases seeking to improve their self-care.[22] Due to the chronic nature of migraine headaches, the active involvement of patients as the self-care agents in self-care activities has a prominent role in comprehensive treatment of migraine which ultimately compels them toward better control of headache symptoms and reducing the costs and disability.[24]

Therefore, providing a self-care program appropriate for patient needs in a supportive educative nursing system format could improve self-care in patients suffering from migraine and reduce migraine-induced disability. Therefore, this study was designed to determine the effectiveness of Orem's self-care program on headache related disability in migraine patients in Tehran, Iran.

Materials and Methods

In this pre-post randomized clinical trial, 88 migraine patients admitted to neurology clinic in Baqiyaiatallah Hospital in Tehran were recruited. After obtaining approval from the ethics committee of the Baqiyatallah Medical Sciences University's Research Deputy, patients who signed the informed consent and met inclusion criteria were selected and randomly assigned to experimental or control groups with simple randomization method. The inclusion criteria included having episodic migraine headaches based on criteria of International Headache Society (with or without aura), aged 20-55 years, minimum ability of reading and writing, having no other disease or disability that affects quality of life such as psychological or other chronic diseases, no history of hospitalization due to headache, and patients who experienced at least five attacks in a month that attacks continued for 4-72 hours. The exclusion criteria included failure to perform the intervention properly, patients' unwillingness to continue participating in the study, and hospitalization due to migraine or other situation.

The instruments used for collecting data included a demographics questionnaire, Migraine Disability Assessment (MIDAS) questionnaire, Orem's cognition form, and self-care checklist. MIDAS questionnaire is a standard questionnaire that its reliability has been confirmed in other studies by acceptable level of Spearman's correlation coefficient (0.77-0.82).[25-27] In this study, to determine the reliability of the MIDAS, daily diary card and test-retest were used. Spearman's correlation coefficient test was 0.76 which confirmed its reliability. MIDAS is a short, self-administered questionnaire designed to quantify headache-related disability over a 3-month period. The scoring is based on five disability questions in three dimensions: two questions assess the number of missed or significant limitations to activity days (defined as at least 50% reduced productivity) due to headache in school or paid work activities (school/job dimension); two questions assess the number of missed or significant limitations to activity days (defined as at least 50% reduced productivity) due to headache in housework

activities (housework dimension); one question assesses missed days due to headache in family, social, or leisure activities (social dimension). The total score is the sum of responses to questions 1-5. Two supplemental questions (A and B) provide the physician with additional clinical information about headache frequency and the average pain intensity (scale from zero to 10) of headaches over the previous three months. Based on the total scores, 4 disability grades are:

Grade I (little or no disability, scores range 0-5), grade II (mild disability, scores range 6-10), grade III (moderate disability, scores range 11-20), and grade IV (severe disability, 21 or greater).[27-29]

At first participants of both groups completed the demographics and MIDAS questionnaire. Then, the control group received only usual treatment of the clinic. The intervention as well as usual treatment was performed for the experimental group as follows. First, Orem's cognition forms were filled out by participant in order to determine self-care requirements and these needs were identified in terms of nutrition, physical activity, stress management, and sleeping improvement. Then, the self-care program was designed in three aspects of nutrition (following the diet properly), exercise (daily walking at least for 30 minutes), and progressive muscle relaxation (PMR) (for at least 20 minutes in the morning and at night) to control stress and improve sleep in the form of an Orem's supportive educative nursing system. After the program design, the self-care program was taught in four theoretical and practical sessions of 30-45 minutes. The individual and group sessions were weekly held for patients in the experimental group for one month. The self-care checklist was provided to the patients at the end of each session (to follow up performance of the program) and patients were taught how to complete the checklist. Checklists were tabulated monthly and if the program was followed, the research unit checked the related option or put a negative sign if the program was not followed. At the end of the fourth session (last session of the theoretical training), the patients were provided with a training manual and requested to follow the self-care program and record their actions in the checklist for three months in order to reduce headache attacks and its disability. Meanwhile, the researcher evaluated performance of the intervention in the experimental group personally or by telephone and answered patients' questions during the three months besides following up the intervention in the clinic.

After three months, the self-care checklists of the experimental group were collected and the MIDAS questionnaire was completed personally by the experimental and the control group again. The study steps are shown in figure 1.

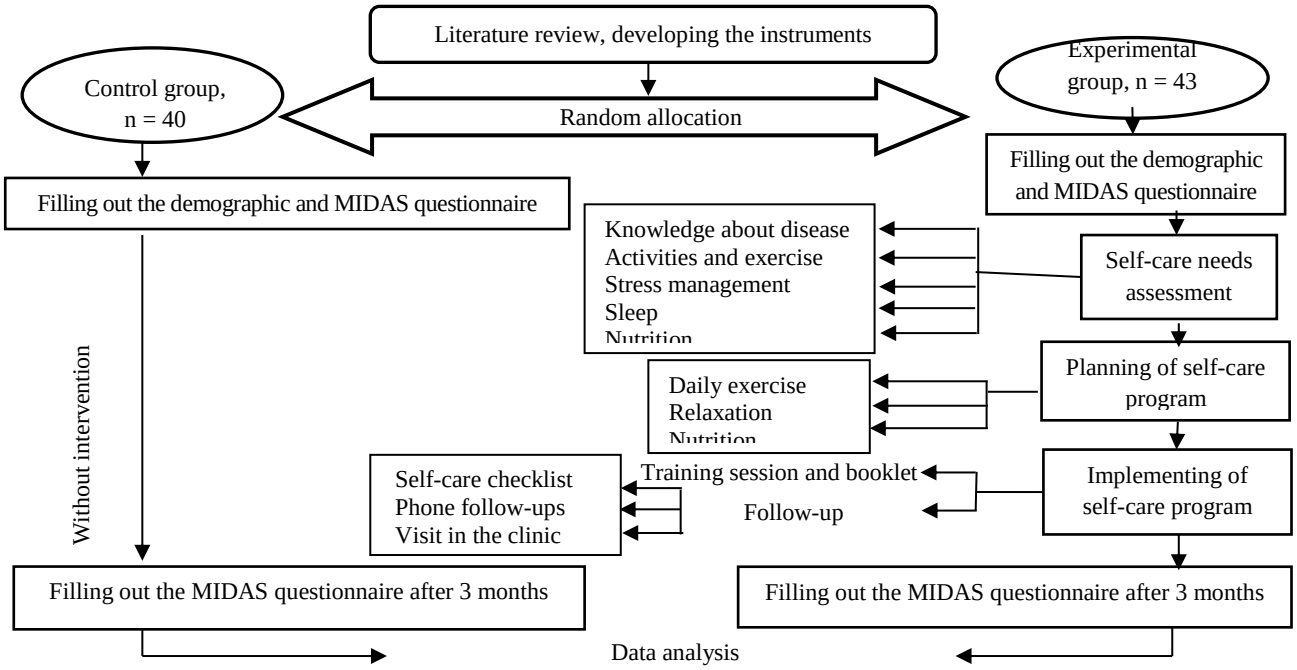

Figure 1. Study process
MIDAS: Migraine Disability Assessment

Regarding the non-normal distribution, the data were analyzed using non-parametric tests by SPSS software (version 16, SPSS Inc., Chicago, IL, USA). The demographic variables were analyzed by chi-square, indicators of disability in patients with migraine were compared between groups by Mann-Whitney U test, and indicators of disability in patients with migraine were tested within groups by Wilcoxon test.

Results

During the study, one patient in the experimental group and four patients in the control group were excluded due to their unwillingness to continue participation, and in total, 83 patients were studied.

Most of the studied patients were female (73.5%) and aged between 20-30 years old. The chi-square test did not show any statistically significant difference between the two groups in terms of demographic variables ($P > 0.050$), which showed homogeneity of the groups (Table 1).

Table 2 shows the mean disability index including the number of missed days and the days with reduced productivity due to migraine before and 3 months after intervention in the experimental and the control groups. Mann-Whitney test showed a statistically significant difference in disability indices of the experimental and control groups after the intervention ($P < 0.001$).

The mean total MIDAS score in the experimental group was 28.1 ± 17.5, which corresponds to MIDAS grade IV (severe disability). However, after the intervention, the total MIDAS score in the experimental group decreased to 6.03 ± 4.52, which corresponds to MIDAS grade II disability. Wilcoxon test showed this difference was statistically significant ($P = 0.001$). But in the control group, the mean of total MIDAS score was 37.6 ± 16.4 before the study which corresponds to MIDAS grade IV; and at the end of study it increased to 55.6 ± 14.5, which is indicative of the increase in migraine-induced disability. The disability remained grade IV, and these statistics showed a statistically significant difference ($P < 0.001$).

Considering self-care needs before the intervention in the field of nutritional needs, 51.2% of patients in the experimental group had irregular nutrition program and 98.8% of them removed breakfast from their daily nutrition program. Also, 62.8% of them had no exercise practice; 55.8% had irregular sleep planning, 37.2% had moderate stress, and 20.9% suffered from severe stress.

Table 1. Demographic characteristics of migraine patients in the two groups

Demographic	Experimental Frequency (%)	Control Frequency (%)	P
Age (year)			0.080
20-30	13 (30.2)	21 (52.5)	
31-40	11 (25.6)	11 (27.5)	
41-50	18 (41.9)	7 (17.5)	
> 50	1 (2.3)	1 (2.5)	
Sex			0.800
Female	31 (72.1)	30 (75.0)	
Male	12 (27.9)	10 (25.0)	
Education			0.620
Propaedeutic	6 (14.0)	3 (7.5)	
Diploma	22 (51.2)	21 (52.5)	
Bachelor's degree or higher	15 (34.8)	16 (40.0)	
Marital status			0.170
Single	6 (14.0)	11 (27.5)	
Married	37 (86.0)	29 (72.5)	
Occupation			0.140
Homemaker	26 (60.5)	16 (40.0)	
Employee	11 (25.5)	13 (32.5)	
Other jobs	6 (14.0)	11 (27.5)	
Economy			0.760
Weak	2 (4.7)	2 (5.0)	
Moderate	33 (76.7)	28 (70.0)	
Good	8 (18.6)	10 (25.0)	

Table 2. Comparison of Migraine Disability Assessment (MIDAS) scores before and after the intervention in the two groups of patients with migraine

MIDAS Subscale	Group	Experimental Mean ± SD	Control Mean ± SD	P
Missed working days	Before	1.18 ± 2.18	1.47 ± 1.86	0.520
	After	0.00 ± 0.00	2.12 ± 2.75	0.001*
Days with reduced productivity	Before	5.04 ± 7.80	7.82 ± 7.88	0.110
	After	1.17 ± 2.67	11.10 ± 11.70	0.001*
Missed household work days	Before	5.72 ± 6.66	6.43 ± 4.17	0.560
	After	0.52 ± 1.32	10.40 ± 5.71	0.001*
Missed days of leisure activities, family and social	Before	4.59 ± 4.74	5.57 ± 3.77	0.390
	After	0.23 ± 0.47	6.57 ± 3.79	0.001*
Total MIDAS scores	Before	28.10 ± 17.5	37.60 ± 16.70	0.110
	After	6.03 ± 4.52	55.60 ± 14.50	0.001*

*P < 0.005
MIDAS: Migraine Disability Assessment; SD: Standard deviation

Regarding relaxation practices after the intervention (self-care checklists), 88.7% of the subjects in the experimental group performed relaxation exercises twice daily in the morning and at night; also 90.7% of them performed the daily aerobic exercise appropriately, and 88.4% of them properly adhered to self-care program in terms of nutrition.

Discussion

The main finding of the present study was that Orem's self-care program resulted in a significant decrease in headache-induced disability after the intervention in the experimental group compared to the controls. Investigating Orem's self-care check list regarding nutrition, it was revealed that 88.4% of participants regularly adhered to self-care program regarding nutrition at home. Understanding the factors that trigger migraine attacks and changing or modifying the lifestyle are important factors in preventing migraine.[30,31] It seems that the experimental group could better manage their headache attacks and reduce the disability by modifying their nutrition program, having their main meals, especially breakfast at regular intervals and avoiding foods that trigger migraines. Also, Buse et al.[32] and Nazari and Eghbali[33] in separate studies have greatly emphasized modifying nutrition patterns in order to prevent headache attacks and reduce disability.

In addition, results of the studies by Lemstra et al. in Canada[34] and Smith et al. in Washington[18] on the effect of a training intervention in patients with migraine revealed a significant decrease in number and severity of headache attacks after the intervention in the experimental group which is consistent with the results obtained from this study.

Stress and sleeping disorders are among other prevalent known triggers[35,36] and in this study, the PMR was designed in order to reduce stress and improve the sleeping habits. Covering the whole body, PMR enables patients to concentrate on their body muscles and achieve complete relaxation.[10] More than three-fourths of experimental group performed relaxation exercises in the morning and at night. Performing morning relaxation could lead to a day full of energy and exhilaration and performing night relaxation could lead to better sleeping. It is believed that when the body is relaxed, the mind cannot be in a state of panic and fear.[37] Moreover, D'Souza et al.[38] in their study aimed at the effect of relaxation training and written emotional disclosure on people with tension or migraine headaches showed that relaxation exercises compared to both written emotional disclosure and the control group improved headache and disability frequencies. Results of the studies during the period 2001 to 2009 revealed that relaxation significantly reduced stress, improved sleep, improved the mood of people suffering from migraine and consequently reduced headache and its consequent disability.[39-41] These results all affirm findings of the present study.

Design of aerobic exercise programs in this study was performed based on the promising findings in various studies indicating the positive effects of aerobic exercises on reducing the frequency and severity of headache attacks and resulting disability.[42-44] More than three-fourths of experimental group in this study performed the daily aerobic exercise properly. The main finding of the present study emphasizes the effect of exercise on reducing the number of headache attacks and the consequent disability. Varkey

et al.[42,45] revealed that performing aerobic exercises reduces the number, intensity and the duration of headache attacks. They concluded that exercising is an appropriate preventive option for migraine in patients who do not benefit from drug therapy or are not willing to take daily medicine.[31,42,45] Also, similar results obtained in Koseoglu et al.[46] study that showed that aerobic exercise increased plasma beta-endorphin level, and consequently increased pain threshold in patients with migraine and reduced number and severity of headache attacks. Results of the study by Dittrich et al.[40] as well as the one carried out by Totzeck et al.[47] also supported the findings of the present study regarding the positive effect of aerobic exercises on controlling and preventing the headache attacks and reducing the disability caused by headache.

Moreover, results of the present study are consistent with the results acquired from the studies being conducted on self-care model format in accordance with the application of the self-care program in controlling the headache attacks and reducing the migraine disability. For example, Rosmawati et al.[22] study about the evaluation of supportive-developmental nursing program on self-care practices of persons with type 2 diabetes showed that mean scores of total and subtotal self-care in the experimental group were significantly higher than those in the control group. Furthermore, Naji et al.[48] study revealed a significant increase in the quality of all aspects of life in patients under hemodialysis in the experimental group after performing Orem's self-care program compared to the control group. Baraz et al.[49] study also showed that training the elderly by Orem's self-care pattern increased the quality of all aspects of their life in comparison to the control group. Hamedanizadeh et al.[50] study also revealed a significant decrease in headache indexes in the experimental group after performing Orem's self-care program compared to the control group.

One of our findings was that in the control group, despite receiving medical treatment and proper medications, the severity of disability was increased at the end of study. The question that arises here is whether performed medical interventions or prescribed drugs did not work properly or the increase in the indicators was related to something else. Medication, especially new drugs to reduce headache attacks were largely successful so the cause cannot be attributed to lack of efficacy of drugs or medical procedures. According to literature, this phenomenon in the control group could be justified by non-compliance behaviors. Lehane and McCarthy[51] in their study concluded that 30 to 50 percent of medications were not taken as prescribed and this led to adverse effect of drugs, adverse outcomes of disease, and increase in health care costs. Hekmatpour, et al.[52] study showed that the main reasons for non-compliance are undesirable outcomes of initial treatment, frequent visits by multiple physicians with different experience, drug interactions, tiredness from taking the medication, and lack of patient education. The same reasons were seen in this study.

Conclusion

According to the result, mean total scores of MIDAS in experimental group showed a significant decrease after intervention compared to the control group. Therefore, we found that self-care programs are suitable for the needs assessment, understanding the level of patients' information and self-care, and provide a basis for acquiring positive results in order to decrease disability and save patient treatment costs**.** On the other side, since migraine headaches have a chronic nature and most patients are not willing to take long term medication and considering migraine is prevalent in the first three decades of life, most patients have the required ability to perform the self-care and provide the life sustaining requirements. Consequently, self-care activities could be considered as an important part of comprehensive migraine treatment. Because migraine patients are treated as outpatient in pain clinics, it is appropriate to provide self-care programs suitable to their needs and based on patients' information and to provide a basis for acquiring positive results in order to decrease disability and save treatment costs.

Conflict of Interests

The authors declare no conflict of interest in this study.

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