

A COMPARATIVE STUDY BETWEEN EFFECTIVENESS OF 6-MINUTE WALK TEST
VERSUS 6-MINUTE WALK ON TREADMILL TO IMPROVE BREATHING IN NON-
SPECIFIED ASTHMATIC PATIENTS

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ABSTRACT-

Background: To compare effectiveness between six-minute walk test versus six-minute walk on treadmill.

Asthma is a chronic disorder of the bronchial tree, characterized by entirely or partially reversible airway obstruction, which may improve spontaneously or may subside only after particular therapy.

In India, prevalence of asthma is around 6% in majority of surveys. However, it has been reported to vary from 2 to 17% in different study populations. Exercise induced airway obstruction occurs in up to 23% of school children and has serious repercussions affecting the quality of life of these children. The 6MWT is a submaximal exercise test that entails measurement of distance walked over a span of 6 minutes. The 6-minute walk distance provides a measure for integrated global response of multiple cardiopulmonary and musculoskeletal systems involved in exercise.

The 6MWT provides information regarding functional capacity, response to therapy and prognosis across a broad range of chronic cardiopulmonary conditions.

Methods: A comparative analysis study was performed to assess the effectiveness between 6-minute walk test versus six minute treadmill walk to improve breathing in non-specified asthmatic patients in the group of 45 to 60 years. 40 subjects with random sampling were recruited over a period of 3 months according to the inclusion and exclusion criteria, each assigned into 2 groups. All the subjects performed the 6MWT on treadmill and corridors successfully and were analyzed on parameters like HR, RR, BP pre and post test.

Results:

Walking in a corridor is more familiar to the patients. The mechanical resistance of pulling a tread may have required greater effort from the subjects compared with walking in a corridor. Tests performed on a motorized treadmill cannot be standardized properly. Practice effect is a well-known phenomenon in the 6MWD-C test, and the present data showed that the 6MWD-T test acted similarly. Therefore, similar to the 6MWD-C test, in the clinical or research setting, the 6MWD-T test should be performed at least twice to account for practice effects. Nevertheless, it is noticeable that the increase in distance walked after each test repetition was higher for the 6MWD-T test. This is likely because people are more familiar with walking on the ground than on a treadmill.

Conclusion:

In conclusion, the finding of this study will enable healthcare professionals and researchers to use the 6MWD-T test as an alternative to the 6MWD-C test when undertaking pre–post comparisons and when a 30-m corridor is not available. Although this study was performed on non-specified asthmatic patients, these findings may have implications for execution of the 6MWD-T test within cardiac and pulmonary rehabilitation.

Keywords: Randomized controlled trial, 6MWT-CORRIDOR, 6MWT-TREADMILL, Non-specified asthmatic patients.

INTRODUCTION

Asthma is a chronic disorder of the bronchial tree, characterized by entirely or partially reversible airway obstruction, which may improve spontaneously or may subside only after particular therapy. Airway hyper-responsiveness is distinct as narrowing of the airways in response to variety of stimuli, such as allergens, non-specific triggers and infections. Asthma is a chronic disorder of both children and adults, with 300 million individuals afflicted worldwide^{1,2}.

Asthma symptoms contain recurrent wheezing, coughing, chest tightness and dyspnea, with early morning and night symptoms being more prevalent, leading to reduced quality of life³. Symptoms of asthma may previously occur early in life with approximately a third of children wheezing during their first 3 years of life⁴.

In many children, the severity of symptoms diminishes in near the beginning of puberty and may even disappear altogether, especially in those with mild asthma. It is widely known that symptoms may remain in children with severe asthma or return in early adulthood⁵.

In India, prevalence of asthma is around 6% in majority of surveys. However, it has been reported to vary from 2 to 17% in different study populations. Exercise induced airway obstruction occurs in up to 23% of school children and has serious repercussions affecting the quality of life of these children. It also confines participation in sports and play with 79% of children experiencing exercise induced airway obstruction as the most burdensome of their asthma.

Six-minute walk test is a reliable and applicable functional test for assessing exercise tolerance and endurance in healthy children. A recent review of functional walking tests concluded that six –minute walk test (6MWT) is easy to perform with better acceptability. The six-minute walk test (6MWT) is often used to measure

functional exercise capacity, assess prognosis and evaluate response to treatment across a widerange of respiratory disease.

The 6MWT provides information on physical performance. The 6MWT allows an estimation of individual response to incremental maximal exercise and accurately reflects physical ability of patients with pulmonary disease.

The incremental shuttle walk (ISWT) and endurance shuttle walk test (ESWT) are newer tests of functional exercise ability that are increasing in popularity, particularly in COPD. The last 10 years has seen a growing body of research describing the use and properties of these three tests. As a result, the European Respiratory Society (ERS) and American Thoracic Society (ATS) have jointly developed a new technical standard to provide clinicians and researchers with guidance on evidence-based, standardized testing procedures for respiratory disease..

The 6mwt is a submaximal exercise test that entails measurement of distance walked over a span of 6 minutes. The 6-minute walk distance provides a measure for integrated global response of multiple cardiopulmonary and musculoskeletal systems involved in exercise.

The main s for performing a 6MWT in a patient with cardiopulmonary disease is to measure response to medical or surgical intervention. It is also used to measure functional status and evaluate prognosis in various medical and surgical conditions.

Breathing exercise breathing also known as diaphragmatic breathing or deep breathing is defined as an efficient integrative body mind training for dealing with stress conditions. Diaphragmatic breathing involves contraction of the diaphragm, expansion of the belly, and deepening of inhalation and exhalation, which consequently decreases the respiration frequency and maximizes the amount of blood gases. Benefits of diaphragmatic breathing have been investigated in association with meditation (Lehrer et al.,2010).

Literature has not found to compare study between effectiveness of 6-minute walk test versus 6-minute walk on treadmill to improve breathing in non-specified asthmatic patients. So, this study designed to identify effectiveness of 6-minute walk test versus 6-minute walk on treadmill to improve breathing in non-specified asthmatic patients.

METHODOLOGY

A comparative analysis study was performed to assess the effectiveness between 6 minute walk test versus six minute treadmill walk to improve breathing in non-specified asthmatic patients in the group of 45 to 60 years. 40 subjects with random sampling were recruited over a period of 3 months according to the inclusion and exclusion criteria, each assigned into 2 groups. All the subjects performed the 6MWT on treadmill and corridor successfully and were analyzed on parameters like HR, RR, BP pre and post-test.

INCLUSION CRITERIA

1. Age of 45-60 years.
2. Diagnosed with non-specified asthma.
3. Both male and female patients.

EXCLUSION CRITERIA

1. Age- <45,> 60
2. Unstable hypertension.
3. Acute M.I.
4. Pneumonia.
5. Respiratory allergies.
6. Fractured lower limb.
7. Cancer patient
8. Mentally retarded patients.
9. Psychiatric disorder

PROCEDURE

40 patients with asthma were randomly selected based on inclusion and exclusion criteria.

They were divided into two groups: Group A & Group B (20 patients in each group)

Patients of Group A (20 subjects) performed a 6-minute walk test in a corridor and patients of Group B (20 subjects) performed a 6-minute walk test on a treadmill.

Written consent forms were collected from the patients selected by inclusion criteria and exclusion criteria.

All subjects were informed that they are under the experiment.

Breathing exercises and incentive spirometry exercises were done for this study. (for both groups)

Our study period was 45 minutes per day, 4 days per week, total 12 weeks.

Exercise	Set	Repetition	Time(min.)
Breathing Exercise	5	10	10
Spirometry	5	10	20
6MWT	--	--	6
Rest	--	--	9



Subjects Performing 6MWT in corridor



Subjects performing on treadmill

DATA ANALYSIS

STATISTICAL TOOL:

Dependent 't' test. The following statistical tool was used to compare the pre and post test values within the group.

Formula: Dependent t-test

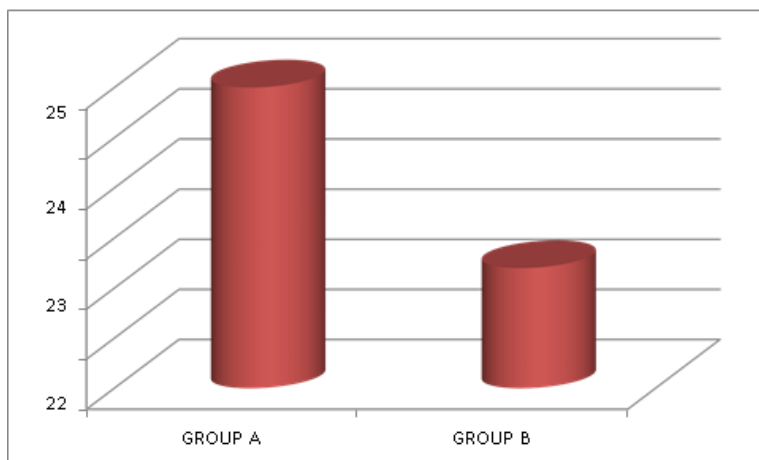
RESULT

TABLE 5.1: Comparison of pre-test and post-test values of scores of levels among group-A.

Group	Measurements	Mean	Mean difference	Standard deviation	Paired 't' test	'p' value at 0.005
A	PRE-TEST	6.7	3.9	0.73	16.8	0.003
	POSTTEST	2.8				

The above table shows that, pre & post-test mean, mean difference, standard deviation, 't' value of asthma. Hence alternative hypothesis was accepted

GRAPHICAL REPRESENTATION COMPARISON OF PRE-TEST AND POST-TEST VALUES OF SCORES OF LEVELS OF AMONG GROUP-A.



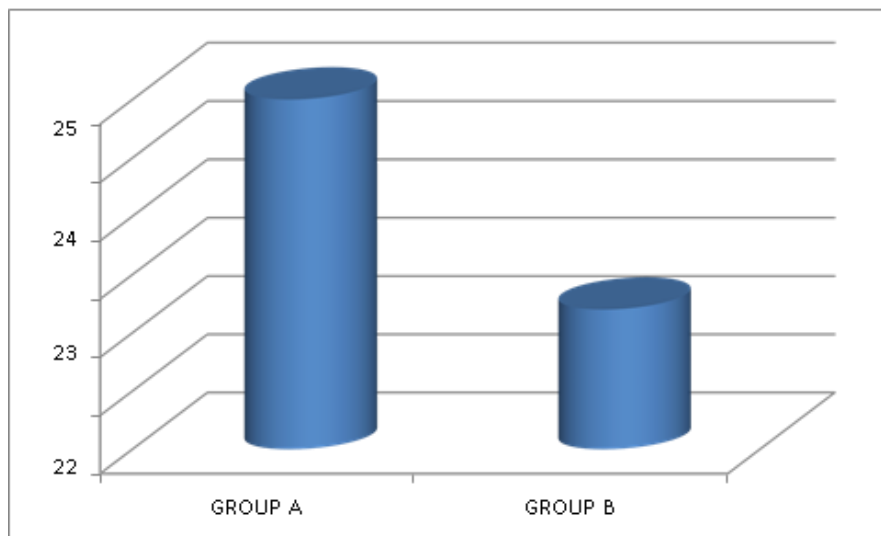
Shows graphical representation of pre and post-test mean values GROUP A

COMPARISON OF PRE-TEST AND POST-TEST VALUES OF SCORES OF LEVELS OF AMONG GROUP-B

Group	Measurements	Mean	Meandifference	Standard deviation	Paired't'tes t	'p' value at0.005
B	PRE-TEST	6.6	3.0	0.93	10.9	0.004
	POSTTEST	3.8				

The above table shows that,pre & post-test mean, mean difference ,standard deviation,'t' value of asthma. Hence alternative hypothesis was accepted

GRAPHICAL REPRESENTATION COMPARISON OF PRE-TEST AND POST-TEST VALUES OF SCORES OF LEVELS OF AMONG GROUP-B.



Shows graphical representation of pre- and post- test mean values GROUP B

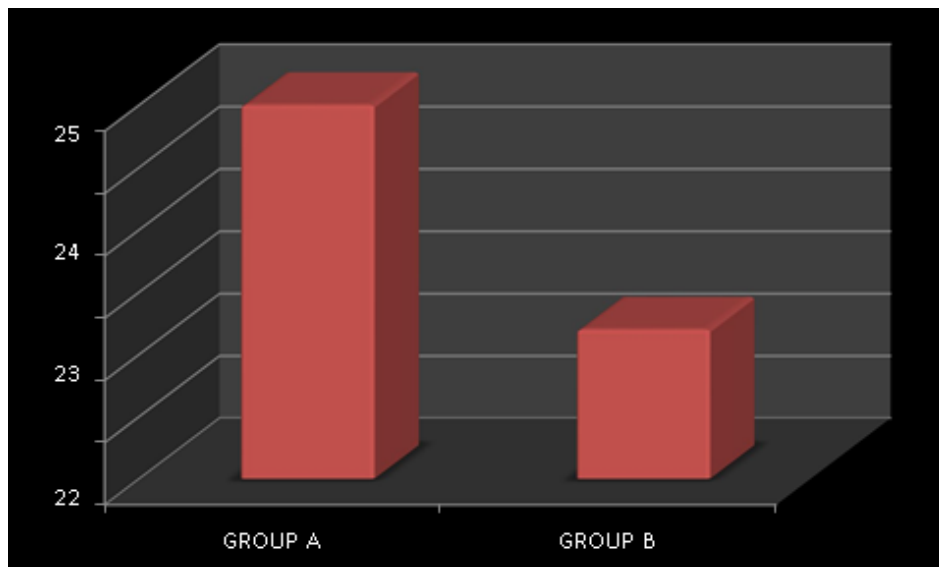
TABLE COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

SIXMINUTEWALKTESTINCORRIDOR

S.N	GROUP	MEAN	STANDARD DEVIATION	't' value
1	GROUP A	564.10	6.856	6.92
2	GROUP B	590.0	11.420	

GRAPHICAL REPRESENTATION COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

SIXMINUTEWALKTESTINCORRIDOR



SHOWS GRAPHICAL REPRESENTATION OF COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

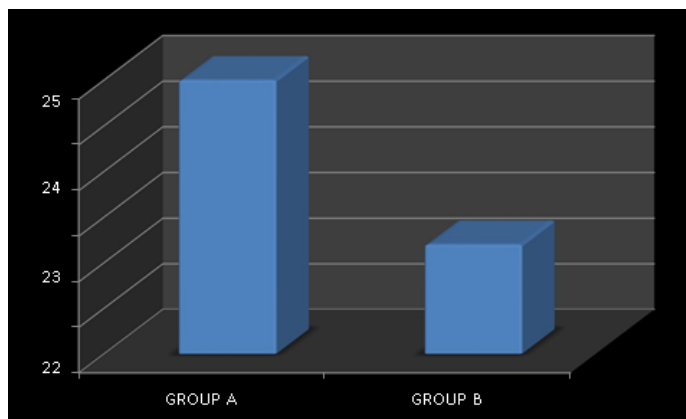
**COMPARISION BEETWEEN THE POST TEST VALUES OF GROUP
A AND GROUP B**

SIX MINUTE WALK TEST ON TREADMILL

S.N	GROUP	MEAN	STANDARD DEVIATION	't' value
1	GROUP A	35.69	2.40	6.92
2	GROUP B	36.40	1.98	

**5.3 GRAPHICAL REPRESENTATION OF COMPARISON BETWEEN THE
POST TEST VALUES OF GROUP A AND GROUP B**

SIX MINUTE WALK TEST ON TREADMILL



SHOWS GRAPHICAL REPRESENTATION OF COMPARISON BETWEEN THE POST TEST
VALUES OF GROUP A AND GROUP B

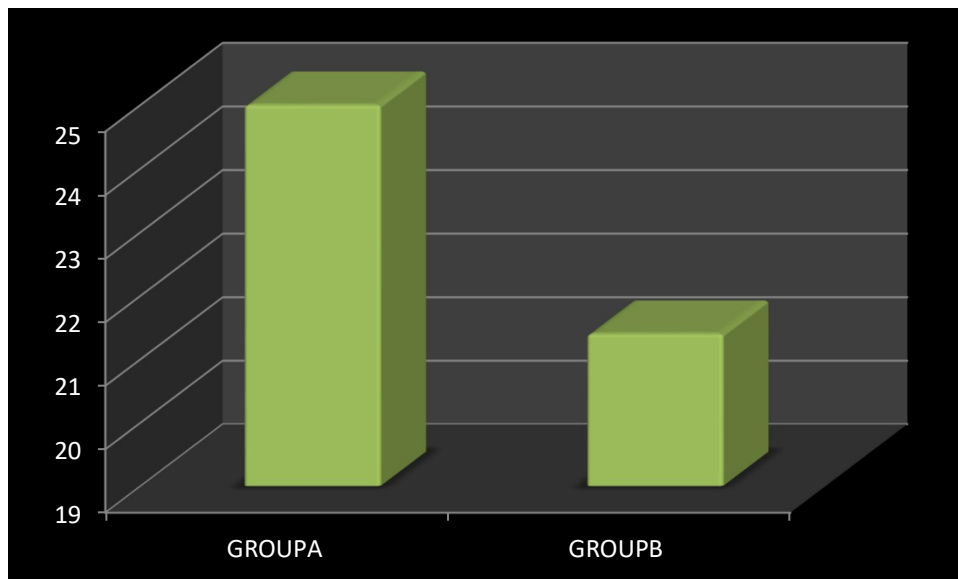
**COMPARISON BETWEEN THE POST TEST VALUES OF
GROUP A AND GROUP B**

Modified Borg scale

S.N	GROUP	MEAN	STANDARD DEVIATION	't' value
1	GROUP A	25.00	4.24	2.69
2	GROUP B	21.40	2.68	

**GRAPHICAL REPRESENTATION OF COMPARISON BETWEEN THE POST TEST VALUES OF GROUP
A AND GROUP B**

Modified Borg scale



SHOWS GRAPHICAL REPRESENTATION OF
COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

DISCUSSION

The important findings of this study are: (i) there was an average discrepancy between the two methods (the mean difference in distance walked between the tests was 153.3m, with the subjects walking a shorter distance on the non-motorized treadmill); (ii) the performance of the subjects during the 6MWD-C and 6MWD-T tests was consistent regardless of the day; and (iii) although the data indicated a certain practice effect of performing three tests on the same day, the 6MWD-T test is reproducible and reliable. Given that the 6MWD test is likely the most widely used test to measure functional exercise capacity in older adults [1], this study is important as many clinics around the world cannot perform this corridor due to lack of space.

Furthermore, tests performed on a motorized treadmill cannot be standardized properly. The authors were unable to find studies that examined validity and reliability of a non-motorized treadmill to perform the 6MWD test. However, a few studies have used a motorized treadmill to perform the 6MWD test in patients with COPD. Beaumont et al. Found no significant difference in distance walked between the 6MWD-C test and the 6MWD test on a motorized treadmill in patients with COPD. However, only 10 patients participated in the study. In contrast, two later studies showed differences in distance walked between the 6MWD-C test and the 6MWD test on a motorized treadmill, indicating that the tests were not interchangeable. The present authors hypothesized that the use of a non-motorized treadmill, compared with a motorized treadmill, would better represent the 6MWD-C test as the speed is fully controlled by the subjects and there is no minimal speed at which the subject has to start the test. Interestingly, the subjects walked a shorter distance on the non-motorized treadmill compared with what they covered in the corridor. Although the subjects in this study practiced for a couple of minutes on the treadmill before the test, walking in a corridor is unquestionably more familiar to the patients. The mechanical resistance of pulling a treadmill may have required greater effort from the subjects compared with walking in a corridor, which consequently made them walk less. In addition, the non-motorized treadmill used in

this study had a slight angle which, in theory, exists to make it easier for the individuals to pull the tread. However, this slight inclination may have imposed extra work for the subjects. These factors may also explain the increase in subjective ratings of perceived exertion and leg fatigue, and the differences in variability in distance walked between the two methods. In this study, the distance walked during the 6MWD-C test ranged from 540 to 561m. This is in line with results of previous studies on healthy elderly individuals, where the distances walked were between 494 and 631m. A randomized controlled trial by the authors' group used the same non-motorized treadmill as was used in the present study to measure functional exercise capacity in patients with moderate to severe COPD. The patients in that study walked between 210 and 400m during the 6MWD-T test before an exercise training period. These distances are slightly lower than those observed in the present study, in which the distances walked by healthy elderly individuals ranged between 376 and 408m. This small difference between the distance walked by healthy elderly subjects in the present study and patients with COPD in the previous study could suggest that the 6MWD-T test may be an applicable test for patients with chronic lung disease despite the apparent increased work during walking. The finding that the distance walked improved, to some extent, after each test repetition in both methods is surprising. Practice effect is a well-known phenomenon in the 6MWD-C test, and the present data showed that the 6MWD-T test acted similarly. Therefore, similar to the 6MWD-C test, in the clinical or research setting, the 6MWD-T test should be performed at least twice to account for practice effects. Nevertheless, it is noticeable that the increase in distance walked after each test repetition was higher for the 6MWD-T test. This is likely because people are more familiar with walking on the ground than on a treadmill, where a practice effect turns out to be more evident. Importantly, the mean differences between test repetitions a and b, and b and c in the 6MWD-T test were small, suggesting good test-retest reliability. In addition, when test-retest reliability between days was examined, the results showed that both the 6MWD-C and 6MWD-T tests are reliable with mean differences between days of -7.2m (6MWD-C) and -1.6m (6MWD-T). High variability was found for the 6MWD-T test between days and between test repetitions compared with the 6MWD-C test. This could be due to the fact that the subjects had different levels of experiences with a treadmill prior to the study. Some subjects were familiar with the equipment while others were not; however, this information was not recorded. This emphasizes the importance of performing at least two test repetitions. Although sample size was not calculated prior to this study, the confidence interval of the limits of agreement was only ± 6.78 , which indicates good reliability of this estimate. Also, it is considered that a larger sample size would not have changed the

estimate of agreement, but would only have narrowed the confidence interval around the limits of agreement. This is because sample size calculations for studies of agreement between two methods of measurement are based on the confidence interval of the limits of agreement and on the standard deviation of the differences between measurements by the two methods. The study data showed that the 6MWD-T and 6MWD-C tests are not interchangeable, suggesting that distance walked during a 6MWD-T test should not be predicted from a 6MWD-C test or vice versa. Thus, there should be consistency in the type of test used before and after an intervention. In addition, predicted values for the 6MWD-C test cannot be used for the 6MWD-T test, and data comparisons with studies that performed the 6MWD-C test should not be undertaken. The 6MWD-C test is undoubtedly the gold standard test to assess functional exercise capacity in healthy older adults and people with heart and lung disease. Nevertheless, there is a need to search for alternative tests due to space restrictions. The results of the 6MWD-T test showed good intra subject reliability, suggesting that this method could be an alternative option to the 6MWD-C test when a long corridor is not available

CONCLUSION

In conclusion, the finding of this study will enable healthcare professionals and researchers to use the 6MWD-T test as an alternative to the 6MWD-C test when undertaking pre-post comparisons and when a 30-m corridor is not available. Although this study was performed on non-specified asthmatic patients, these findings may have implications for execution of the 6MWD-T test within cardiac and pulmonary rehabilitation

FURTHER SCOPE OF STUDY

Furthermore, a non-motorized treadmill is cheaper, smaller, lighter and easier to standardize than a motorized treadmill. Evidently, other alternatives such as the step test, cycle test and shuttle walk test have been used to assess exercise capacity in healthy elderly subjects and people. The 6MWD test is more representative of activities of daily living, allowing the patients to walk at their own pace. One purpose of performing an exercise test prior to a rehabilitation programme is to allow the prescription of an exercise programme based on the result of the 6MWD test. Given that the subjects in this study walked shorter distances on the non-motorized treadmill, one could argue that the 6MWD-T test would affect the identification of an

effective training intensity. However, not every rehabilitation Centre use the results of the 6MWD test to prescribe an exercise Programme, as many centers use treadmills or bicycles. Accordingly, we believe that the 6MWD-T test could be used before and after a rehabilitation Program in order to measure exercise capacity.

LIMITATIONS OF THE STUDY

The study was limited due to shorter duration of treatment

The study was limited due to less number of nonspecific asthmatic patients. The study was limited to age group between 45 – 60 years

The study was limited to only 6MWD-C versus 6MWD-T for treatment of nonspecific asthmatic patients.

Only patients diagnosed with non-specified asthma were taken as a sample.

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