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Research Article

Evaluating Quality Adjusted Life in Acute Ischemic Stroke Patients: Insights from Door-to-Needle Time Observations

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ABSTRACT

Aim/Background: To assess the safety and effectiveness of tenecteplase in acute ischemic stroke patients treated within 3.5 hr of symptom on set, evaluating its potential as a cost-effective treatment option. **Materials and Methods:** Study population: 38 patients over 35 years old, Demographics: Predominantly male (62.5%), age range 56-65 years, Lifestyle analysis: 58.3% smokers, 44.7% alcohol consumers, Treatment: Tenecteplase administered within 3.5 hr of symptom onset. **Results:** Patient Outcomes: 94.73% achieved independence in daily activities; 56.25% experienced shorter hospital stays (3-5 days); 81.05% positive outcomes at discharge; 94.21% improvement after one month; Quality-Adjusted Life Year (QALY) analysis showed significant improvement; Demonstrated cost-effectiveness compared to other thrombolytic treatments. **Conclusion:** Tenecteplase emerges as a safe and cost-effective treatment for Acute Ischemic Stroke, demonstrating significant improvements in neurological recovery, patient independence, and potential reduction in healthcare costs while enhancing patient quality of life.

Keywords: Tenecteplase, Acute Ischemic Stroke, Quality-Adjusted Life Year (QALY), Neurological recovery, Alcohol consumption.

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INTRODUCTION

Stroke is a major cause of death and adult disability worldwide and a serious medical emergency. According to the World Health Organization (WHO) study, Stroke is the second most significant cause of death globally. A stroke is a neurological disorder caused by a disruption in the blood flow to the brain. Every year, stroke takes the lives of almost six million individuals.[1] Stroke is the fifth leading cause of disability and the fourth common cause of death. In India, there are between 105 and 152 strokes for every one million individuals annually. This demonstrates how the prevalence of stroke has been rising in India over the last few decades. However, because there are few studies and data accessible, and the data that has been obtained even lacks consistent methodologies, the dependability of the current data is extremely low. This underscores the necessity for a more comprehensive and systematic study on the national stroke epidemiology.[2] Hemorrhagic and ischemic strokes are the two main types of strokes; hemorrhagic strokes are brought on by blood vessel rupture, whereas ischemic strokes are often caused by blockage of blood supply to the brain.[3] A blood clot that develops in the arteries, stops blood flow to the brain, resulting in a thrombotic stroke, a subtype of an ischemic stroke. Another type of stroke is an embolic stroke, which is brought on by constriction or blockage of an artery, typically in the pulmonary or cardiac arteries. One of the main characteristics of ischemic stroke is inadequate brain perfusion, which is frequently caused by atherosclerosis. In addition, uncommon vascular diseases and arterial rupture can cause ischemic strokes.[4] Frequent reported risk factors were smoking, dyslipidemia, a family history of stroke, hypertension, and a history of stroke or transient ischemic attack.[5] Effective stroke care requires both primary and secondary prevention of stroke, with an emphasis on managing modifiable risk factors.[6] Fibrinolytic drugs are used as part of the therapy of ischemic stroke in order to break up the clot by thrombolysis. These substances cause the formation of plasmin from the precursor plasminogen, which breaks out clots. Tissue Plasminogen Activator (t-PA), causes fibrinolysis and disintegrates thrombi. In the treatment of stroke, Tenecteplase (TNK), a modified t-PA derivative, has a longer duration of 24 min as compared to Altepase's 4-5 min, stronger clot solubility, and greater fibrin specificity. These characteristics help arteries recanalize more quickly, which encourages vascularization

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and speeds up the healing process. TNK, which was created with recombinant DNA technology, has the potential to be an effective therapy for ischemic stroke since it has superior safety characteristics and clinical results.[7]

The study aims to assess the Tenecteplase extends lifespan and offers cost-effectiveness for patients with acute ischemic stroke who arrive at the hospital within 3.5 hr of symptom onset. The study's findings will provide a comprehensive analysis of cost-effectiveness, focusing on reduced hospital stays and Quality-Adjusted Life Years (QALY), assessed through questionnaires measuring physical activity levels.

MATERIALS AND METHODS

Study Design

This observational study took place in a multi-specialty hospital, involving 38 patients, to evaluate the Quality-Adjusted Life Years (QALY) associated with tenecteplase in patients with acute ischemic stroke who arrived within the therapeutic window. Conducted from March to August 2023, the study spanned six months following ethical approval by the hospital (Registration No: ECR/319/Inst/TN/2013/RR-19). Patient outcomes were measured using NIHSS, MRS, and MRC scales.

Inclusion and Exclusion Criteria

The study included male and female patients over the age of 35 with acute ischemic stroke, significant deficits on NIHSS, MRS, and MRC scales, and co-existing conditions. Exclusions were applied to those under 35, those presenting outside the 3.5-hr therapeutic window, patients with recurrent ischemic or hemorrhagic strokes, stroke-related seizures, or recent major surgery within the past 14 days.

Data Collection Method

Data were collected from eligible patients using a structured proforma and checklist capturing demographics (age, gender, height, weight), medical and medication history, lifestyle habits, vital signs, lab findings, stroke onset time, daily living activities, and scores on the MRC, MRS, and NIHSS scales. Tenecteplase details (dosage, timing, route) were noted, along with a pre-treatment CT scan and regular monitoring of vital signs. Questionnaires assessing patients' physical activity levels were administered to evaluate quality-adjusted life. Any significant changes in clinical investigations were recorded.

Data Analysis

Data analysis involved calculating percentages to determine QALY and the cost-effectiveness of tenecteplase for patients who arrived within the therapeutic window for acute ischemic stroke.

RESULTS AND DISCUSSION

In Table 1, the demographic data indicate a greater prevalence of stroke among males, representing 62.5% (25 patients), as opposed to females, who comprised 37.5% (13 patients). The largest age group affected was 56-65 years, making up 39.5% (15 patients), followed closely by the 46-55 age group at 36.8% (14 patients). Smaller proportions were observed in the 35-45 age brackets at 7.8% (3 patients) and the 66-80 age range at 15.7% (6 patients). Additionally, lifestyle analysis showed that 58.3% (24 patients) were smokers, while 44.7% (17 patients) reported alcohol use. In this study, tenecteplase enabled 94.73% (n=36) of patients to perform daily activities independently, as assessed through questionnaires and regular monitoring shown in Table 2. In this study, the majority of patients, 56.25% (n=20), experienced a reduced hospital stay of 3-5 days, indicating that tenecteplase played a significant role in reducing hospitalization time. This reduction contributes to lower financial burden on patients and demonstrates cost-effectiveness in treating thrombolysed acute ischemic stroke patients compared to other thrombolytic agents mentioned in Table 3. The study done by Yang H *et al.*, was about the daily activity living which confirms that acute ischemic patient can able to climb the stairs which is equivalent to the study for the thrombolysed patients using tenecteplase.[8] Similar study was conducted by Dasari D *et al.*, where tenecteplase shows a more effective and less expensive when compared to other thrombolytic agents.[9] A study conducted by king CM discussed about the hospital stay was similar for both the thrombolytic agents of tenecteplase and Altepase for the management of AIS.[10] According to Table 4, the QAL scores for 38 patients, derived from 10 questionnaire responses with positive outcomes scored as 1 and negative outcomes as 0, showed an improvement of 81.05% (n=20) at discharge and 94.21% (n=36) after a one-month follow-up. In this study, to determine the Quality-Adjusted Life Year (QALY) for patients, a utility value of 0.9 was applied, resulting in QALY gains of 2.25 (2.5 yearsX0.9),

Table 1: Demographic data.

Demographic Details	35-45	46-55	56-65	66-80
Age	3 (7.8%)	14 (36.8%)	15 (39.5%)	6 (15.7%)
Male	0 (0%)	10 (26.3%)	13 (34.2%)	2 (5.3%)
Female	3 (7.9%)	3 (7.9%)	3 (7.9%)	4 (10.5%)
Smoker	1 (2.6%)	9 (23.7%)	10 (26.3%)	4 (10.5%)
Alcoholic	0 (0%)	8 (21.0%)	7 (7.9%)	2 (5.3%)

Table 2: Distribution based on patient's activity of daily living.

Activities of Daily Living	Frequency	Percentage (%)
Dependent	2	5.26%
Independent	36	94.73%

Table 3: Distribution based on patient's activity of hospital days.

No. of Hospital Days	Frequency	Percentage (%)
3-5	20	56.25%
6-8	16	42.01%
9-12	1	2.6%
13-15	1	2.6%

Table 4: Distribution based on quality adjusted life using questionnaires.

Scale	Time of Discharge	Percentage (%)	After 1 month	Percentage (%)
0 to 2	2	5.26%	2	5.26%
3 to 4	0	0%	0	0%
5 to 6	3	7.89%	0	0%
7 to 8	13	34.21%	0	0%
9 to 10	20	52.63%	36	94.73%

1.35 (1.5 yearsX0.9), and 0.45 (0.5 yearsX0.9). This indicates an increased lifespan for thrombolysed patients compared to those treated with other thrombolytic agents. A study conducted by Lee HY *et al.*, where Quality adjusted life expectancy was discussed about the ischemic and hemorrhagic life expectancy which is like this study where QALY is discussed based on the thrombolysed patients using Tenecteplase.[11]

QALY=Years of life x Utility units

CONCLUSION

Our study highlights Tenecteplase as a highly effective thrombolytic therapy for patients with acute ischemic stroke. Tenecteplase distinguishes itself with its longer half-life, simplified administration, and cost-effectiveness. This treatment not only enhances safety by increasing patient lifespan but also significantly reduces hospital stays, thereby lowering morbidity and mortality rates. In summary, Tenecteplase is an innovative and impactful thrombolytic option for managing acute ischemic stroke.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

QAL: Quality Adjusted Life; **QALY:** Quality Adjusted Life Year; **AIS:** Acute Ischemic stroke.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

As this is a review article, it is involved animals subjects, the study spanned six months following ethical approval by the hospital (Registration No: ECR/319/Inst/TN/2013/RR-19). Patient outcomes were measured using NIHSS, MRS, and MRC scales, and thus ethics approval is necessary.

STUDY LIMITATIONS

The study duration was only six months, so the patients involved in the study were limited, and difficult to score the patients after 30 days of treatment as they did not adhere to the follow-up, so the accurate mortality rate was found to be difficult. The patients were contacted via phone call to obtain their scores one month later.

CONTRIBUTION DETAILS

Balaprasath. B acquisition, Literature search and Manuscript preparation.

Aswathee Sivakumar, Abin Benny, Boobalan. R-Concept, design and Manuscript editing.

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