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Review Article

The Best Time to Start Stroke Rehabilitation: A Review of the Evidence in Resource-Adequate and Resource Constrained Settings

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Structured Abstract
Background: Stroke is a global health problem and one of the major causes of death, disability and impairment among adults worldwide. Post-stroke outcomes vary widely, between and within world regions depending on a range of factors including demographic profile, stroke type, severity and immediate and long-term post stroke care. It has been reported that early initiation of rehabilitation following stroke promotes better long-term outcomes than delayed rehabilitation, although this has been disputed by some researchers in the AVERT (A very early rehabilitation trial) study.
Purpose of Review: To evaluate the best time to start stroke rehabilitation with good outcomes
Results of the Review: There is limited evidence to show that later rehabilitation is better than early rehabilitation. It also remains unclear whether early mobilization is more effective than mobilization at a later stage, due to insufficient statistical power of the studies that have examined this practice because clinicians around the world are practicing this model to this day. Furthermore, some trial limitations of the AVERT study in line with the uncertainty of the external validity of the results, make generalizability something to be concerned about.
Conclusion: The best time to start stroke rehabilitation is as soon as the patient is clinically stable i.e; as early as possible. The results of the poor outcomes of the AVERT study in providing evidence of the impact of early stroke rehabilitation, should not be interpreted as proof of the ineffectiveness of early physical rehabilitation. Every stroke is different from one person to another because the impact of the damage to the brain is associated with the different functions of several parts of the brain making generalizability quite difficult. Therefore, in the absence of provision of high quality evidence, clinicians like physiotherapists should base their decisions on clinical experience, individual circumstances and patient preferences as appropriate. It is extremely important to develop evidence-based practice protocols that can guide clinical practice on the best time to start stroke rehabilitation and also enhancing plasticity and reducing the negative impact of stroke through pharmacotherapy, especially for survivors in resource constrained places like sub-Saharan Africa.

Keywords: Stroke, Rehabilitation, Resource Adequate Settings, Resource Constrained Settings

1. INTRODUCTION

Stroke is a global health problem and major cause of death, disability and impairment among adults worldwide [1-5]. In spite of its global impact, the term "stroke" is not consistently defined in clinical practice, clinical research, or assessments of public health [6]. The clinical syndrome of stroke is characterized by an acute loss of focal brain function lasting more than 24 hours and in some cases, may lead to death. It is thought to be due to either inadequate blood supply to a part of the brain as a result of low blood flow, thrombosis or

embolism associated with cardiovascular diseases or spontaneous haemorrhage into the brain substance [6-8]. The etiology of stroke is influenced by sex, race and age, as well as by cultural and geographic factors [9]. Stroke is classically divided into two types being ischemic stroke which is characterized by neurological deficit attributed to an acute focal injury of the central nervous system (CNS) and haemorrhagic stroke characterized by a focal collection of blood within the brain parenchyma or ventricular system that is not trauma-related [6,8]. The frequency of ischemic stroke is higher than hemorrhagic stroke [8-12] and it is also known to be the second most common cause of death worldwide [13,14] and the third leading cause of the loss of disability-adjusted life years [13,15].

Several epidemiological studies have been done worldwide to highlight the global trends of stroke, including estimated projections of the syndrome. According to the American Stroke Association [16], statistics show that stroke sufferers were 33 million, with 16.9 million people having a first stroke worldwide in 2010. On average in Africa, stroke sufferers are possibly 10 to 15 years younger than those in developed countries [17,18]. Stroke has been responsible for 5.3 million deaths or 1 in 10 deaths worldwide [6]. It has been predicted that, if the current trends of non-communicable diseases (NCD) continue, there will be 20 million annual stroke deaths and 70 million stroke survivors worldwide by 2030 [19-21]. The global burden of stroke reflects a pressing need for well-designed strategies to help track current trends as well as to curb the projected spread of stroke worldwide, especially in low-income countries (LIC) [22].

Stroke rates in several developed countries have fallen considerably, while they have been reported to rise substantially over the last 20 years in Africa, giving an overall global increase in stroke incidence [20-23]. Such assertions are supported by data showing that in the year 2008, the overall stroke incidence rates in LIC to middle income countries (MIC) had, for the first time, exceeded the level of stroke incidence seen in high-income countries (HIC), by 20% [8, 22]. Certainly, from the reports given, the burden of stroke in sub-Saharan Africa (SSA) appears to be increasing, and post-stroke disability rates in some areas are as high as in HIC [23]. Epidemiological reports presented show that new stroke cases in Africa amounted to 535, 000 and 2, 009, 000 stroke survivors in the year 2013, suggesting an increase of 10.8% and 9.6% of incident stroke cases and stroke survivors respectively, attributable to population growth and ageing between 2009 and 2013 [21].

Undoubtedly, African countries are currently undergoing an epidemiological transition that has been driven by socio-demographic and lifestyle changes hence giving statistics in some few places never reported before. Although the burden of care of NCD, including cardiovascular and other risk factors seem to be increasing steadily in SSA [24]. The scarcity of data on stroke incidence is equally becoming more pronounced in Africa, especially the rural parts [21, 25]. Even though it is believed that more than 80% of stroke burden occurs in LIC and MIC, reliable data on stroke epidemiology, particularly incidence and morbidity is scarce in most of these settings [20]. Consequently, long-term post-stroke outcomes in SSA are poorly described, with most studies being hospital-based. As the majority of stroke cases may not attend hospital, such data cannot be relied upon to give an accurate picture of the epidemiology of stroke in SSA [23].

Post-stroke outcomes vary widely, between and within world regions depending on multiple factors including demographic profile, stroke type, severity and immediate and long-term post stroke care [23]. Various lengths of hospital stay post stroke have been documented in literature although improvement of outcomes relates not specifically to the length of stay, but to the intensity of the rehabilitation received. Traditionally, starting rehabilitation early is a widely accepted principle of care for people affected by stroke [26-30]. Other assumptions related to improved outcomes and recovery which are facilitated by a greater intensity of treatment in stroke, have also been reported [31]. Some of these traditional assumptions have now been doubted due to the outcomes of a randomised controlled AVERT trial study recently done on 2104 patients from 5 HIC [32]. The purpose of the trial study was to evaluate if very early mobilisation reduces disability at 3 months in stroke survivors. The study concluded that very early mobilization after stroke reduces the probability of a favourable outcome at 3 months.

What is already known in Stroke Rehabilitation?

- Rehabilitation of stroke should start as soon as a patient is declared stable for enhancing functional independence
- Heat Rate Variability is strongly associated with motor outcome 3 months after stroke
- Cerebrolysin has beneficial effects on function and global outcome in early rehabilitation patients after stroke
- Treatment with fluoxetine for 90 days after ischemic stroke can improve the long-term neural functional outcomes.

What is not known in Stroke Rehabilitation?

- The basis on how rehabilitation influences brain plasticity and recovery is unclear
- It is unclear how early immobilization affects neurological outcomes
- The optimal intensity of rehabilitation is unclear

What this study adds:

-It provides current literature on the overview of stroke rehabilitation and also provided an opinion on the impasse that has arisen from the AVERT study on the best time to start stroke rehabilitation
-Motivation to clinicians especially in resource constrained environments to develop collaborative protocols that can be enhanced by pharmacotherapy in order to reduce the negative impact of stroke and eventually improve on outcomes.

Considering the impasse that has been created by the trial results, it has become very evident now that there has been very little clear consensus about the optimal time to start stroke rehabilitation. As such, there is a critical need to assess the current evidence on the best time to start rehabilitation in stroke survivors. Henceforth, we conducted a review of literature reported in this paper. Information on stroke rehabilitation, stroke rehabilitation guidelines, approaches to stroke rehabilitation, rehabilitation in resource constrained and resource adequate settings and our clinical opinion on the best time to start rehabilitation will be presented.

Research Question

What is the best time to start Stroke Rehabilitation?

Main Purpose of Review

To review the evidence of stroke rehabilitation in resource adequate and resource constrained settings and the best time to start rehabilitation with good outcomes

Methodology

The search process involved an electronic search of literature on the review topic, while the conclusions were based on literature findings and the consensus clinical views of the authors based on their experiences of stroke rehabilitation.

2. STROKE REHABILITATION

Rehabilitation is often prescribed after brain injury, but the basis on how training can influence brain plasticity and the recovery is unclear [33]. It is a broad concept, though a dynamic process of care including prevention and/ or treatment activities and/or services that address body impairments, activity limitations or participation restrictions for an individual [32-36]. It is considered to be the cornerstone of stroke management, with physiotherapy being the most recognized and generally accepted treatment [37]. Rehabilitation is an integral part of most physiotherapists' work, even if the work environment is not a clearly defined 'rehabilitation' setting [38]. Because of the high burden of disability and the lack of a widely applicable medical treatment, much of post-stroke care relies upon rehabilitation interventions [6]. Due to the burden of care in managing stroke survivors, global stroke rehabilitation guidelines have been developed in many countries.

2.1 Stroke Rehabilitation Guidelines

With the increased burden of stroke survivors, global stroke rehabilitation guidelines have been developed to guide clinical practice and equally several approaches have been developed for use in stroke rehabilitation be it in the HIC or LIC. Several stroke rehabilitation guidelines have been developed in different countries to provide clinical guidance in managing stroke survivors. For instance, the National Clinical Guidance for Stroke (England) [39], Clinical Guidance for Stroke Management (Australia and New Zealand) [40], the Royal Dutch Society for Physical Therapy (Koninklijk Nederlands Genootschap voor Fysiotherapie (KNGF) Stroke Rehabilitation Guidelines (Netherlands) [41] and other guidelines are guiding practice in their respective countries and other countries where there are no specific guidelines for use. However, the most recent updated stroke rehabilitation guideline being the KNGF was developed using the framework based on the 'International Classification of Functioning, Disability and Health' (ICF) [42]. The guidelines offer information on the process of stroke rehabilitation, post stroke problems encountered and also approaches being used in managing stroke survivors.

The Process of Stroke Rehabilitation

In accordance with the KNGF Stroke Rehabilitation Guideline, the process of rehabilitation can be divided into three phases of care i.e. (I) early rehabilitation phase between 0-24hrs to 3 months, (II) late rehabilitation phase between 3-6 months and (III) rehabilitation in chronic phase after 6 months as shown in figure 1. The processes involved in stroke rehabilitation are physical therapy and other modalities like occupational and speech therapy which involve diagnostics and prognostics, intervention, evaluation and monitoring, and concluding the treatment [41].

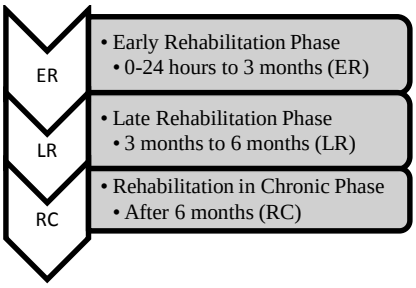

Figure 1: Process of Stroke Rehabilitation

The main goal of stroke rehabilitation is to maximize the ability to walk independently and improve activities of daily living [31, 43] and also promoting the use of the affected arm. It is generally recommended that stroke rehabilitation be carried out in what is called a stroke unit characterised by a specialized integrated stroke care system, sometimes referred to as 'stroke service' [39-41]. In an ideal situation, a stroke unit is found in a hospital setup while other places are rehabilitation stroke units in rehabilitation centres and nursing home stroke units found in nursing homes. It has been demonstrated that having patients with CVA treated by a specialised interdisciplinary stroke team, who are working together at one common site has a favourable effect on survival rates, length of stay, and ADL independence, compared to regular care at a non-specialized ward [39-41]. Ideally, a treatment team consists of a physician, nurse, physical therapist, occupational therapist, speech therapist, neuropsychologist, social worker, exercise therapist, activities supervisor, dietician and pharmacist [39-41].

Post-Stroke Problems

A number of studies have been done to evaluate problems encountered by stroke survivors. Stroke survivors are frequently left with physical and psychological changes that can profoundly affect their functional ability, independence, and social participation [43,44] due to walking inability and the disuse of the affected upper limb. It has been observed that spasticity occurs in at least 20% of all stroke patients contributing to movement deficits, pain and impaired function [45]. It is apparent that any disorder of somatosensory function can be an important cause of functional disorder, particularly of the hand [46]. Disorders of the motor and somatosensory functions of the upper limb are frequent clinical symptoms in strokes. Recovery of the somatosensory functions of the upper limb is slower and more complicated than in the lower limb [47,48]. Some studies have shown that somatosensory deficit has a negative

effect on the functional outcome of patients with hemiplegia and prolongs rehabilitative treatment. In the case of the upper limb, the poor functional recovery occurring with sensory loss can be at least in part due to a "learned non-use" mechanism that has been documented in studies with both animal models and human subjects with somatosensory deficits [49]. The observations suggest that after stroke, an impaired processing of afferent input from the affected side leads to a defective neural coupling and is associated with a greater involvement of fibre tracts from the unaffected hemisphere during cooperative hand movements [50, 51]. It is reported that at 6 months of stroke rehabilitation, 33–66% of people with upper extremity impairments do not present with functional upper limb and only 5–20% achieve full recovery [52]. In order to manage problems of stroke survivors, several rehabilitation approaches have been developed dating as far back as the 1940s.

Approaches used in Stroke Rehabilitation

Historically, several stroke treatment approaches have been developed and used by physical and occupational therapists. Stroke rehabilitation methods used by therapists vary widely depending on their background knowledge, clinical experience, clinical skills, and personal preferences [53]. Therapeutic methods and techniques used within neurological physical therapy provide two main approaches being: traditional classical specific intervention techniques and the eclectic approach to intervention. The traditional classical specific intervention techniques are based usually on strict procedures and clinical guidelines while the eclectic approach is based on the stable core of the methods and open to development and conjunction elements of various methods [54]. There are various neurophysiological approaches like Proprioceptive neuromuscular facilitation techniques (PNF), Bobath's neurodevelopmental approach (NDT), Brunnstrom's technique and Rood's approach that can be used in stroke rehabilitation although there are a lot of variations in the use of these approaches depending on the therapists. A proportion of almost 96% of therapists are well aware of neuro approaches, but face difficulties practicing them. Proprioceptive neuromuscular facilitation techniques and Constraint-Induced Movement Therapy (CIMT) are most commonly preferred and practiced approaches, followed by NDT, Brunnstorm, Roods and Motor Relearning Program (MRP). There is a mixed pattern of practice of traditional approaches such as PNF, Brunnstorm and NDT and the task specific training such as CIMT [55].

Surveys have been conducted in countries including Sweden, Australia, and the United Kingdom to determine the clinical practices and the underlying theoretical beliefs in stroke rehabilitation among the current practices of clinicians who use the neurodevelopmental treatment (NDT) method. The uncertainty among clinicians revealed in some sections of the survey shows that more evidence of clinical approaches is needed to ensure efficacious treatments. Development of a comprehensive treatment protocol based on basic and clinical scientific evidence using current therapeutic practices that are supported by the literature should be investigated [53]. Various physical rehabilitation approaches may be used to promote recovery of function and mobility after stroke, but controversy and debate about the relative effectiveness of approaches persist [56]. Spasticity therapy has become important in today's neurological clinical rehabilitation [43]. A review of randomized controlled trials of physical rehabilitation approaches in adult stroke survivors was done with interventions of philosophically different approaches to promote recovery of function or mobility. Results showed that physical rehabilitation, comprising a selection of components from different approaches, is effective for recovery of function and mobility after stroke [56].

In spite of debates going on concerning the effectiveness of stroke rehabilitation, it is well established that the amount of therapy patients receive is key to the effectiveness of stroke rehabilitation [57]. One approach to rehabilitation post stroke that results in improved long-term outcomes is early initiation of therapy. For instance, functional activity dose during the first week of inpatient rehabilitation is an indicator of both gait velocity at discharge and length of time to independent walking [58]. A number of approaches are now being investigated in an attempt to increase the effectiveness of stroke rehabilitation techniques for the Upper Extremity [59]. In the last decades, robot-assisted rehabilitation has been used to promote motor ability in stroke patients. The additive effects of robot-assisted rehabilitation with respect to traditional therapy still have to be demonstrated [60, 61]. It is widely accepted that intensive repetitive task-oriented robotic rehabilitation is an effective intervention but, at present, the mechanisms leading to impairment reduction following the robotic training are still unclear. In addition, it is unknown when the reduction in impairment leads actually to improved quantity and quality of upper-limb use in activities of daily living. To date, there is still no consensus on which robot and kind of approach should be used given a selected patient or on the duration of the robotic intervention. There are various robots and approaches for upper-limb neuro-rehabilitation but, due to the lack of knowledge of the mechanisms leading to improvement and the complexity and the variety of the clinical pictures of stroke patients, there are no generally recognized guidelines on how to select the robotic intervention and how to customize it on the patient's residual functional abilities [60].

Acupuncture has also been used for patients with stroke and post-stroke rehabilitation for thousands of years [62]. Previous studies reported that acupuncture enhanced stroke recovery through neurogenesis while current findings suggest that it is a prospective therapy targeting neurogenesis for ischemic stroke. The findings of a systematic and meta-analysis review indicate that acupuncture ameliorates neurological deficits and reduces brain oedema in experimental ischemic stroke, and the mechanisms positively correlate with endogenous neurogenesis, in which acupuncture therapy can promote the proliferation, migration and differentiation of Neural Stem Cells [63].

Several limitations have been found in individual approaches to rehabilitation and no one approach to physical rehabilitation is any more (or less) effective in promoting recovery of function and mobility after stroke [56]. Therefore, clinicians both in resource adequate and resource constrained use different approaches to suit the needs of stroke patients in what is called an eclectic approach. It is therefore imperative that rehabilitation professionals managing stroke survivors develop comprehensive treatment protocols to provide some

form of clinical guidance to clinicians working in both resource constraint and resource adequate settings.

2.2 Rehabilitation in Resource Constrained and Resource Adequate Settings

The body of literature on stroke rehabilitation clearly establishes that there are different approaches to stroke rehabilitation in developed and developing countries. However, the differential approaches do not necessarily represent preferred models or best practice [31]. Although rehabilitation in developed countries tend to follow recommended stroke rehabilitation guidelines, rehabilitation provided in developing countries is often dependent on the availability of resources, which are often limited. Where resources are available especially in private and church institutions, good and basic rehabilitation takes place somehow. Of course, it is very clear that in the developed countries, everything is streamlined and has to be done as per stroke protocol. For instance, the protocol entails that all patients be admitted to a hospital stroke unit for further diagnostics not later than 4.5 hours after the stroke and physiotherapy starts mobilizing patients 24 hours after the stroke in order to prevent secondary complications [27]. This can be evidenced in countries like the Netherlands where early mobilization of stroke patients defined as 'mobilizing a patient from the bed within 24 hours after the stroke, and encouraging them to practice outside the bed' is what is advocated for [27].

Although there are pragmatic debates going on globally on stroke rehabilitation, the majority of stroke survivors in Africa cannot even make it to the hospital within 24 hours going by the universal stroke rehabilitation guidelines. Equally, diagnosis of stroke in many African settings remains a huge challenge [64]. For instance, CT scans in some hospital surveys in SSA have been reported to be conducted on less than half of patients presenting with stroke, while only a few can afford it. Furthermore, due to the high proportion of undiagnosed hypertension in Africa especially among the younger population, stroke incidence has also been reported to be more severe and higher among the active and productive population age groups. The high cost of health services in the absence of effective health insurance schemes and adequate resources allocated for stroke prevention and management has affected healthcare-seeking behaviour in some African settings [64]. This has practically forced many stroke patients to be managed at home due to lack of hospital funds, with only a few presenting to standard health facilities several days after the onset of symptoms having tried low-priced under-resourced clinics. In some resource-poor countries like Mozambique, the average length of hospital stay is only 6 days and so functional ability is likely to be a strong marker for stroke severity [23]. Other reports from studies on 651 stroke cases in Mozambique, 200 cases in Johannesburg, South Africa, 284 cases in Lusaka, Zambia and 272 cases in Abuja, Nigeria have reported case-fatalities of between 28–30 days giving a proportion of between 16.2% - 38% [8, 23]. Most of these studies in the developing world have reported cases managed and the average number of days of hospitalization, but outcomes of rehabilitation have been limited to rates of mortality and morbidity.

Undoubtedly, the majority of studies exploring recovery and outcome of stroke management have been conducted in developed high-income countries where factors that enhance the outcomes of rehabilitation are more readily available [4]. In contrast, there is very limited literature reporting on outcomes and recovery patterns of stroke patients living in developing or under-resourced countries. Due to limited resources, there is indeed a lack of adherence to global best clinical practice stroke guidelines which could help improve on outcomes. Also a multidisciplinary approach is seldom applied because some disciplines are not being employed at the centres due to limited funds and clinicians. An attempt was made to compare the motor and functional recovery of stroke patients in Germany versus stroke patients receiving rehabilitation in South Africa. Secondary data analysis of patient protocols collected in two independent studies conducted in Germany and South Africa was done on a total of 73 patients from the two separate studies. They were matched for age at stroke onset, gender, and initial motor functioning. The results of this study provide empirical evidence for differential recovery patterns for patients in developed and developing countries. It was noted that German patients performed better than the South Africa counterparts in performing activities of daily living at 6 months. This could be attributed to the differences in the processes of rehabilitation where German patients received in-patient treatment of high intensity of daily therapy on an average of 2.5 hours while the South Africans received an out-patients therapy at an average of once per week. Thus the intensity of treatment differed significantly between the developed and developing countries, potentially impacting outcome and recovery patterns. A further detailed exploration of the factors to which this difference in recovery patterns can be attributed was beyond the scope of the study hence another study for future research was recommended [4].

Even though it has been demonstrated that having patients with stroke treated by a specialised interdisciplinary stroke team is what is recommended, such services can hardly be provided in most African countries. This contributes to widening the gap of clinical practice of stroke rehabilitation in the developed world verses the developing world. On the other hand, if assertions that early rehabilitation has poor outcomes, then SSA could perhaps provide an even bigger sample to provide evidence of better outcomes. Most of the stroke survivors do not have an opportunity to be seen by a neurologist or physiotherapist but prescriptions are given and in many instances, drugs are not even available even making stroke management more complicated. Whatever the circumstances, clinicians world over are currently facing a dilemma on the best time to start stroke rehabilitation.

3. WHAT IS THE BEST TIME TO START STROKE REHABILITATION?

Some researchers have reported that early initiation of rehabilitation following stroke promotes better long-term outcomes than delayed onset, emphasizing the importance of in-patient therapy [58, 65, 66] although it has been disputed by other researchers [67]. Generally, the concept of starting rehabilitation early has been well supported and a widely accepted principle of care for people affected by stroke [27,

67]. Even though there is limited evidence and it still remains unclear whether early mobilization is more effective than mobilization at a later stage, due to insufficient statistical power of the studies that have examined this practice, clinicians around the world are practicing this model to this day. However, as there were no reported indications disputing that early mobilization from the bed has any adverse consequences for patients provided the patient's neurological and cardiovascular status has been judged by a neurologist to be sufficiently stable, stroke guidelines are still recommended.

In an attempt to establish with evidence the best time to start rehabilitation, a randomised controlled AVERT trial study with concealed allocation and blinded outcome study was recently done on 2104 patients from 56 stroke units in five countries namely Australia, New Zealand, Malaysia, Singapore and the United Kingdom [67]. The purpose of this study was to evaluate if very early mobilisation reduces disability at 3 months in stroke survivors. The intervention was delivered by physiotherapy and nursing staff guided by a protocol, which was dictated by four levels of functional ability and adjusted in line with recovery. The intervention period lasted 14 days or until discharge from stroke unit care. The study concluded that very early mobilization after stroke reduces the probability of a favourable outcome at 3 months. The trial shows that a theoretically plausible intensive intervention and very early mobilisation of stroke patients begun as soon as possible after admission, is not better than existing protocols and may actually be harmful [67]. The results of this trial may imply that the existing guidelines worldwide on early stroke rehabilitation need to be rewritten. The trial has been actually considered a labour of love for the hundreds of clinicians, researchers and patients involved. The collective vision of research excellence and discovery, of building the stroke rehabilitation and recovery evidence base was clear and ever present. So too was the shared value of collaboration, of participating in something that extended beyond national boundaries [67]. As further results emerge, clearer guidance for practice will be possible. The 'who', 'when' and 'how much' questions remain. However, this important finding has already set a new discovery path. Additional pre-clinical studies may clarify the time window for enhanced plasticity after injury, and focused exploratory trials in stroke patients will further aid the understanding. For now, the key message for physiotherapists is that AVERT has proven that what you do with patients early after stroke does make a difference [67].

A very recent commentary was done on the AVERT study by a director of a Neuro-critical Care Services in the USA, Abhijit Lele who clearly stated that the study results largely contradict the conventional thinking and practice of early mobilization after stroke. Considering some trial limitations, he warned that caution must be exercised prior to making any change in clinical practice [68]. It is only true that such a relevant and pragmatic trial study that took 8 years to be completed is very essential in research and the clinical practice of stroke rehabilitation, although cautiousness has to be observed before getting in to worse problems difficult to handle given the uncertainty of the external validity of the results of the trial study and other issues [67], thus making generalizability something to be concerned about.

In conclusion, the authors wish to state that, the results of the poor outcomes of the AVERT study in providing evidence of the impact of early stroke rehabilitation, should not be interpreted as proof of the ineffectiveness of early physical rehabilitation. Physical rehabilitation in patients with critical conditions like stroke may need some complex interventions that are sometimes not easy to study. Every stroke is different from one person to another because the impact of the damage to the brain is concomitant with the different functions of several parts of the brain. Therefore, in the absence of provision of high quality evidence, clinicians like physiotherapists should base their decisions on clinical experience, individual circumstances and patient preferences as appropriate. Benefits of early mobilization should be compared with the potential complications of the negative likely impact of intra-cerebral hemorrhages if caution is not well taken care of by clinicians. Therefore, considering the weaknesses of the AVERT study, literature on stroke rehabilitation, the commentary of Abhijit Lele [68] and the clinical experiences of the authors in stroke rehabilitation, the opinion on this matter is, "Early rehabilitation leads to better future outcomes for stroke patients", (as soon as the patient is clinically stable).

In demonstrating the effectiveness of clinical novelties, it is extremely important to develop evidence-based practice protocols that can improve the recovery of patients post stroke given the severity of the impact of stroke. Further efforts are also needed to identify effective treatment approaches that could strengthen especially upper limb management and also enhancing plasticity and reducing the negative impact of stroke through pharmacotherapy, especially for survivors in resource constrained places like sub-Saharan Africa.

Future Directions

A Clinical Trial Study should be done that will be aimed at guiding clinical practice on the best time to start stroke rehabilitation and also help reduce the negative impact of stroke through pharmacotherapy, especially for survivors in resource constrained places like sub-Saharan Africa.

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