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Original article

CLINICAL FEATURES AND NEUROREHABILITATION IN ISCHEMIC STROKE

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Abstract

Aim. Ischemic stroke is the interruption of brain blood flow by every occlusion of cerebral artery, associated with focal neurological signs and symptoms. Optimal functional recovery is the ultimate aim of neurorehabilitation after acute brain lesion. This paper is an on- going study about neurorehabilitation in ischemic stroke, the first report was done in 2014.

Methods. Between January 2016 - December 2016 we hospitalized on emergency 262 patients with supratentorial ischemic stroke (only self - casuistry). Demographic (sex, age), clinical, imagistic (cerebral-CT, cerebral - MRI), paraclinic data, as well as risk factors, treatment, evolution and early neurorehabilitation were all considered.

Results. We studied 262 patients, 142 males and 120 females (54,20 % versus 45,80 %). The mean age was 72,6 years (range 30-89). According to the age groups, the highest frequency of ischemic stroke is between 70-79 years (88 cases; 33,59%), followed by the age group of 60-69 years (68 cases; 25,95 %). The partition of the cases according to localization of ischemic stroke shows the highest frequency in the superficial territory of ACM (103 cases; 39,31%), followed by the profound territory of ACM (54 cases; 20,61%) as well as the other vascular territories. Clinical features of ischemic stroke depends on the location of brain injury: headache, vomiting, dizziness, hemiparesis, hemiplegia, hemisensory deficits, coma, neuropsychological abnormalities, etc. We started neurorehabilitation in the first 48-72 hours after ischemic stroke onset. In 162 cases (61.83%) it has been a favorable recovery, 70 cases (26,72%) remained stationary after 14 recovery days meanwhile hospitalization and 30 cases (11,45%) died.

Conclusion. The highest frequency of ischemic stroke is between 70-79 years (33,59%) in males (54,20%) and in the superficial territory of ACM (39,31%). Neurorehabilitation, initiated in the first 48-72 hours after ischemic stroke onset, should continue for another 6 months. Clearly, neurorehabilitation which is both focused and intensive is essential to ensure maximal recovery achieved post-stroke.

Key-words: Ischemic stroke, neurorehabilitation.

Introduction

Stroke, the second leading cause of death, is a sudden loss of blood flow to the brain which is commonly cause by either occlusion or rupture of a major cerebral artery. The interruption of brain blood flow by one of these mechanisms is associated with focal sign and symptoms (Bornstein, 2009). In our study we were considered supratentorial ischemic stroke. The clinical manifestations of ischemic stroke are direct consequences of the territory of the vessels involved. The carotid system originates four pairs of long circumferential arteries: the anterior cerebral arteries (ACAs), the middle cerebral arteries (MCAs), the posterior cerebral arteries (PCAs) and the anterior choroidal arteries (AchorAs). As they ramify over the brain surface, branches from the ACA, MCA and PCA penetrate it by sending right-angled short arteries limited to the cortex, short medullary arteries to the subcortical white matter and long medullary arteries that penetrate the centrum semiovale (DeMyer, 1998). Combination of hemodynamic factors and hypoxia may restrict lesions to one or more of these anatomic distributions or may affect all of them (Biller, 2009). There are multiple risk factors for ischemic stroke; only the most common risk factors are reviewed here: age, race, sex, cardiovascular disease, hypertension, cigarette smoking, diabetes mellitus, carotid stenosis, atrial fibrillation, dyslipidemia, obesity, alcohol use, hypercoagulability, oral contraceptive use. Diagnostic imaging in acute stroke may impact on different levels of diagnosis and management; cerebral CT is the most frequently used imaging technique in acute stroke patients worldwide but

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other conditions are better identified on MRI. Using Duplex technology, we can estimate the carotid stenosis by hemodynamic measurement and analyze plaque morphology. We considered the treatment of acute ischemic stroke with platelet aggregation inhibitors, anticoagulants and thrombolytic therapy. The outcome of early rehabilitation is determined by several important factors, including type of lesion, individual characteristics, treatment, outcome measurements and type of rehabilitation unit (Bruce, 2005).

Methods

Between January 2016 - December 2016 we hospitalized on emergency 262 patients with supratentorial ischemic stroke (only self-casuistry).Demographic (sex, age), clinical, imagistic (cerebral-CT, cerebral - MRI, extracranial ultrasound, trans or intracranial ultrasound), paraclinic data, as well as risk factors (cardiovascular disease, hypertension, smoking, diabetes mellitus, carotid stenosis, atrial fibrillation, dyslipidemia, obesity), treatment, evolution and neurorehabilitation were all considered.

Results

We studied 262 patients, 142 males and 120 females (54,20% versus 45,80%). The mean age was 72,6 years (range: 30-89). According to the age groups, the biggest frequency of ischemic stroke is between 70-79 years (88 cases; 33,59%), followed by the age group of 60-69 years (68 cases; 25,95%), 50-59 years (51 cases;19,47%), 80-89 years (26 cases; 9,92%), 40-49 years (19 cases; 7,25%) and 30-39 years (10 cases; 3,82%).(Fig. 1)

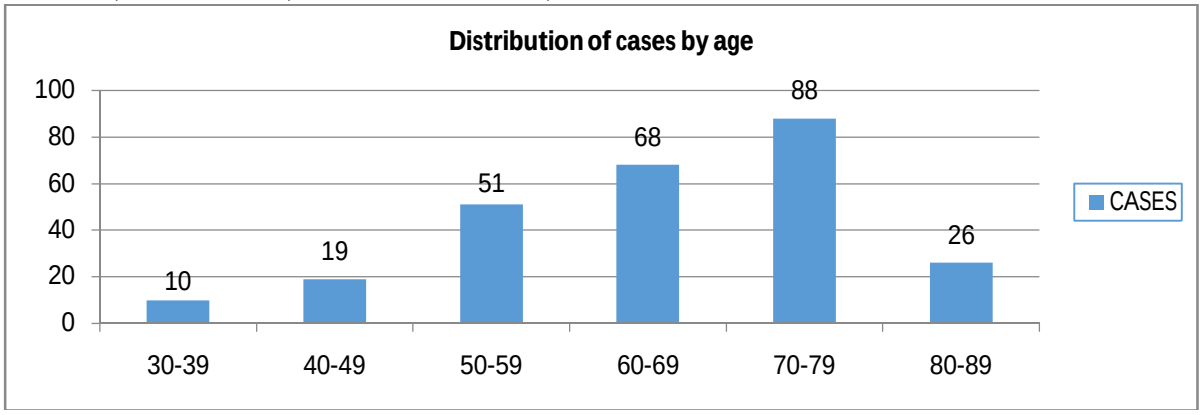

Fig. 1 Partition of the cases according to the age.

The partition of the cases according to the ischemic stroke localization shows that most of the cases are in the superficial territory of ACM (103 cases; 39,31%), followed by the profound territory of ACM (54 cases; 20,61%), as well as the other vascular territories. (Fig. 2)

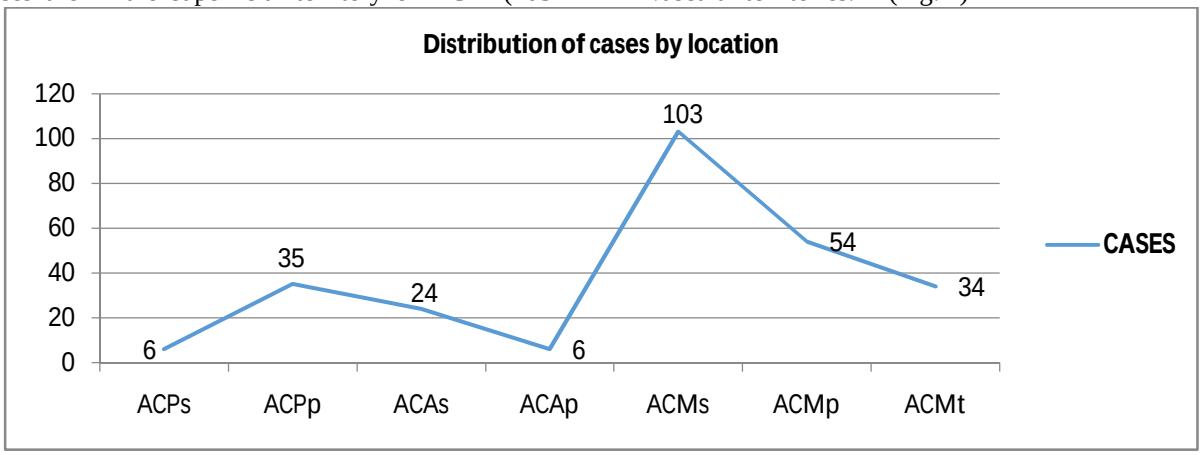

Fig. 2 Partition of the cases according to the ischemic stroke localization.

The patient's neurorehabilitation has been done after 48-72 hours from the ischemic stroke onset. In 162 cases it has been a favorable recovery (61,83%); 70 cases remained stationary (26, 72%) after 14 recovery days meanwhile hospitalization and 30 cases (11,45 %) died. The physiotherapist has considered the clinical type of stroke as well as the seriousness of the functional deficit. (Fig.3)

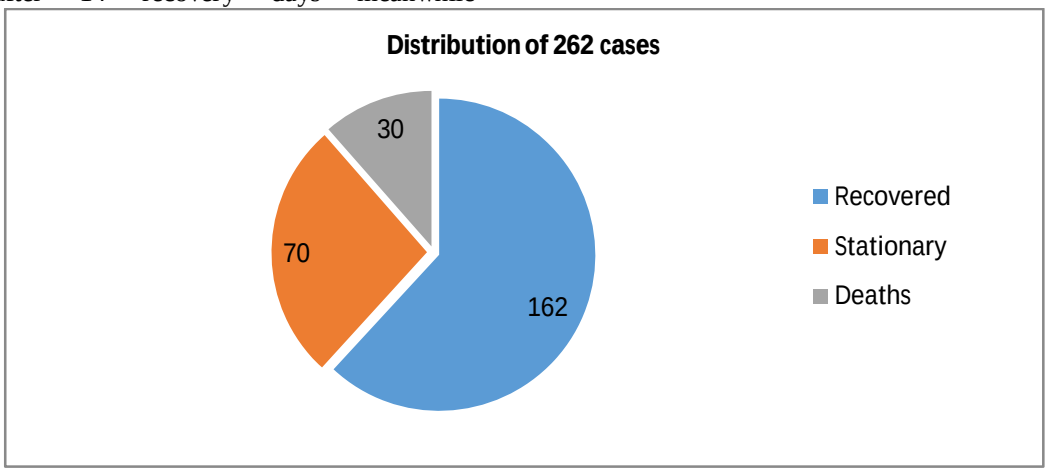

Fig. 3 Partition of the cases according to the prognostic.

Neurorehabilitation

Generally speaking, neurological recovery begins almost immediately after a stroke. The most rapid recovery usually takes place in the first few weeks and months after a stroke, with the largest amount of recovery occurring within the first three to six months. The second six months after a stroke are usually a time of slower improvement, but recovery can continue in many cases for up to one year. Certain aspects of recovery seem to proceed on a different timetable. Recovery and rehabilitation cannot be rushed. The brain, like all human organs, requires time to heal itself. While rehabilitation efforts need to be sufficiently intensive to stimulate the brain's recovery, there is likely a point of diminishing returns, when further increases in therapy time do not provide further benefit. Moreover, if therapy is too intensive, fatigue or exhaustion may reduce a person's ability to focus attention and energy on rehabilitation efforts. As the rehabilitation program progresses, the stroke survivor and his family need to accept increasing responsibility for performing exercises at home without the direct presence of a rehabilitation therapist. This will allow for a smooth transition once formal services end and, perhaps more important, will help the stroke survivor attain the highest degree of function achievable. The real work is always done by the stroke survivor himself (Stein, 2004).

Optimal functional recovery is the ultimate aim of neurorehabilitation after acute brain lesion. The unique contribution of physiotherapy to the rehabilitation of individuals following stroke is the training of motor control based on a contemporary understanding of impairments and secondary adaptations, biomechanics, motor learning, exercise science and factors that influence brain reorganization after injury. The major objective of physiotherapy is the optimization of motor performance in functional actions. If brain reorganization and functional recovery from brain lesions are dependent on use and activity, then the environment in which rehabilitation is carried out is likely to play an important role in patient outcomes. Early after stroke, patients with a lesions system are struggling to learn again how to perform even simple movements as well as everyday actions. They need to practice repetitively in order to get the idea of the action they are (re)learning and to train the neural coordination necessary for effective performance. As they gain more strength and control, less attention can be directed toward performing the action and more attention to the goal and relevant environmental cues. In the early stages of rehabilitation, repetitive practice of an exercise or part of an action is necessary to increase muscle strength and train coordination of the muscular synergies that move the segmental linkage. The therapist should sustain the patient's motivation during repetitive practice, for example, by counting repetitions(or providing a counter), and by providing concrete feedback of the effects of practice in terms of increases in strength

or in speed. It may be useful to explain to the patient that learning continues even though performance may deteriorate due to muscle fatigue. After a rest period or a change to a less demanding or different activity, an improvement in performance is usually evident(Carr at al, 2003).As a general rule, the severity of the initial deficit following stroke is inversely proportional to the prognosis for recovery. Most recovery occurs during the first three to six months following the stroke. The course of recovery decelerates as a function of time and is generally a predictable phenomenon. The majority of patients with less-severe strokes demonstrate no or only mild disabilities, while many patients suffering from very severe strokes will remain dependent in activities of daily living (ADLs), even after the completion of rehabilitation (Stein, 2009).

Balance dysfunction, particularly in standing, is a devastating sequel of stroke since the ability to balance the body mass over the base of support under different task and environmental conditions is one of the most critical motor control factors in daily life. Training balanced movement may be the most significant part of rehabilitation.Following stroke, patients with muscle weakness and poor control lack effective anticipatory, ongoing and reactive postural adjustments and therefore experience difficulty performing actions which involve:

•supporting the body mass over the paretic lower limb

•voluntarily moving the body mass from one lower limb to the other and one position to another

•responding rapidly to predicted and unpredicted threats to balance.

The conditions under which balance control is necessary in daily life can be broadly categorized as occurring:

• during performance of a self-initiated action

•when predicting destabilization and taking avoiding action

•when making a reactive response as a last resort in an attempt to avoid a fall.

Intervention aims to optimize balance by training:

•balance of the body mass during voluntary actions in sitting, standing and during body transport

•quick responses to predicted and unpredicted destabilization.

For training to be effective given the impairments and adaptations following stroke, it is also necessary to:

•prevent adaptive shortening of lower limb soft tissues

•increase lower limb extensor muscle strength and coordination (for support of body mass).

Standing balance. Learning to balance in standing requires the opportunity to practice voluntary actions in this position early in the acute stage. Given that it is critical for the person to practice in standing, if the lower limb tends to collapse, there are several ways of enabling balance practice. The exercises below include movements of the body mass ranging from small displacements when patients are weak and apprehensive, progressing to larger displacements performed faster.

Single leg support (with or without harness or splint)

Stepping forward with non-paretic limb to place foot on a step. Standing with either foot on step, practice reaching tasks - ensure that the stance hip extends. Exercise can be practiced initially in a harness.

Sideways walking

Walking sideways with hand(s) on wall, or raised bed rail. This exercise enables practice of shifting weight from side to side with hips extended.

Picking up objects

Standing, lowering body mass to pick up or touch object, forward, sideways, backward and return:

•ensure that hips, knees and ankles flex and extend.

•start with object on stool to minimize distance to be moved.

•increase flexibility by changing base of support.

Maximizing skill

For balance to improve, individuals are challenged with increasingly difficult tasks and more complex contexts in order to extend their abilities to the limits. Flexibility in coping with a variety of real-life tasks and environmental demands is introduced as soon as possible.

- Reaching and pick-up exercises
- place object beyond stability limit so it is necessary to take a step
- increase weight of object
- increase size of object to require two hands
- include unpredictability
- vary speed of movement
- decrease the area of the base of support, e.g. one foot in front of the other, standing on

one leg, changing compliance of support surface.
- Stepping exercises
- Games to make rapid response time an imperative
- Introduce complexity and uncertainty into the environment

Getting up from the floor.

Teaching individuals how to get up from the floor after a fall is often a priority in rehabilitation involving elderly individuals. A major problem is that many people after stroke have difficulty rising from the floor or find the action impossible unless they have good strength in the lower limb extensors and arm muscles.

Walking. The ability to walk independently is a prerequisite for most daily activities.

The major requirements for successful walking are:
- support of body mass by lower limbs
- propulsion of the body in the intended direction
- the production of a basic locomotor rhythm
- dynamic balance control of the moving body
- flexibility, i.e. the ability to adapt the movement to changing environmental demands and goals.

Walking include:
- slopes - are frequently encountered in everyday life.
- obstacles and kerbs - A common obstacle encountered in everyday life is a kerb or a single step indoors.
- stair walking

Stance phase
- Ankle dorsiflexion for heel contact, plantarflexion to foot flat, dorsiflexion as body mass progresses forward over the foot, pre-swing ankle plantarflexion for push-off
- Knee flexion at heel contact (approximately 15°) to absorb body weight and momentum, extension by mid-stance, flexion (35-40° pre-swing)
- Hip extension to advance body mass forward over the foot (approximately 10-15° beyond neutral) together with ankle dorsiflexion
- Lateral horizontal pelvic shift (approximately 4 cm from side to side)involving adduction at stance hip

Swing phase
- Hip flexion (pull-off) to swing lower limb forward
- Knee flexion to shorten lower limb (35-40° pre-swing, increasing to 60°)
- Lateral pelvic list downward (approximately 5°) toward swing side at toe-off
- Rotation of pelvis about the vertical axis (approximately 4° to either side)
- Knee extension plus ankle dorsiflexion for heel contact

Simple active exercises, by exploring the possibilities, may give the patient the idea of contracting muscles. The natural resting position of the forearm is in pronation. Exercises are necessary to enable practice of active supination and to retain the functional length of supinator muscle. Wrist extension is critical to grasping, manipulating and releasing objects:
- Sitting with arm on table
- Lifting and lowering an object held in palm and (fingers over end of table)
- Lifting glass from table by radial deviation at wrist, forearm in mid-rotation , placing it to left and right by wrist flexion and extension
- Sliding glass along table top to touch target by extending wrist
- Tapping table top with all fingers

Simple exercises to elicit activation of muscles around the shoulder. In supine - therapist lifts arm and supports it in flexion, patient attempts various simple actions (if patient experiences some pain when the arm is lifted into position passively; therapist can apply a minimal amount of traction to avoid nipping of stretched soft tissues between joint surfaces):
- Reach up to touch target
- Take palm of hand to head (eccentric activity of triceps brachii)
- Take hand above head to touch pillow (eccentric for triceps brachii, shoulder adductors/extensors)
- Hand on forehead, move elbow down to pillow and up

Shoulder girdle elevation is a critical part of arm movement and inability to do this action is implicated in poor recovery. The following exercise may enable the patient to get the idea of the movement.

Sitting with forearm supported. Shoulder shrugging. Simple reaching exercises are practiced in sitting with arm supported on table top, for shoulder movement, elbow flexion and extension. These exercises may stimulate deltoid activity spontaneously in order to reduce friction of skin on table:

- Glass of water in hand, arm on table top.
- Slide glass forward in different directions (across the body, out to the side) to touch targets, keeping forearm in mid-rotation
- Slide glass backward and forwards to touch targets by extending and flexing elbow.

When the patient has some muscle activity around the shoulder, reaching exercises are practiced to exercise deltoid (and synergists such as upper trapezius) in small range movements. Start with arm on table at 90° shoulder flexion. Reaching and pointing within controllable range above 90°, gradually increasing range, in forward and sideways directions. There are many activities that can be used to increase speed and precision of movement and, as a result, skill. The patient's help should be enlisted in thinking up tasks to practice that have relevance. Here are some examples:

- Tapping tasks
  - touch each finger tip to thumb in sequence as rapidly as possible (do a given number of sequences within a given time
  - tapping table with single fingers
- Hand-cupping tasks to train opposition of radial and ulnar sides of the hand
  - hold seeds in palm and pour into dish
  - scooping coins from tabletop into palm of other hand (change hands)
- Pick up different objects between thumb and finger(s), place them on various targets
  - pick up objects between thumb and 4th, 5th fingers
  - pick up small objects from inside a cup with thumb and several fingers, thumb and forefinger
  - pick up piece of paper from opposite shoulder
  - pick up pencil, put it down on table, turn it anticlockwise to point in opposite direction, then clockwise; use target lines on tabletop
  - stack dominoes
  - pick up and hold saucer or lid of large jar using 'spider' grip in which hand spans the whole diameter, thumb extended to the maximum, fingers stretched wide
- Pick up larger objects from one side of table and place to other side; vary weight, distance to be moved
  - pick up glass of water and drink
  - pick up jug of water and pour into glass; vary amount of water, size of jug
  - pick up mug of water and drink
- Use a stopwatch to time another member of the group
- More difficult tasks (more complex, or requiring more muscle strength)
  - type on a computer keyboard, play computer games using manipulandum
  - drawing and writing
  - tracing a circle without touching the lines
  - use telephone keypad
  - pegboard tasks, board games, playing cards
  - turn door handles, knobs
  - bounce and catch ball
  - turn page of magazine
  - lift and move saucepan of water, one handle, two handles
  - walk while carrying a glass of water, teacup

As soon as the patient has the ability to control simple movements with the affected limb, bimanual training should begin. The first two exercises can be done with minimal muscle activity. If necessary, the hand can be bandaged to the handlebar.

- Arm cycling
- Bike riding (arms included)
- Push-ups against wall
- Pour water from jug to cup/glass and back
- Fold a towel
- Roll a rolling pin back and forth

- Remove small objects from pockets
- Reaching up to cupboard for box, different weights according to ability
- Walking, walking up and down steps, standing up, holding a loaded tray
- Manipulating a ball

For the patient to learn to manipulate a particular tool (toothbrush, comb, tools of trade or recreation) the therapist analyses the patient's performance of the action to establish what components are preventing effective performance.

In combination with rehabilitation we used: orthoses and alternative or nonconventional therapies.

Use of orthoses should be considered as part of an overall management plan during both the acute and chronic stages of stroke rehabilitation. Furthermore, since stroke recovery is a dynamic process, the use of orthoses should be intermittently reassessed in order to keep pace with the individual's changing abilities. Generally, the primary goal of orthoses during the acute phase is to maintain range of motion and prevent joint contractures that may interfere with eventual functional outcome. For orthoses to be successfully used in the management of stroke, they must be safe, and there must be realistic outcome expectations and appropriate follow-up to ensure proper fit and function. There must be adequate strength and stability of the orthoses to ensure that anatomical joints are protected from unnecessary damage. Orthoses must also minimize the pressure and friction applied to skin and bony prominences by careful fitting and padding. Furthermore, the axes of mechanical joints must be aligned with that of anatomic joints in order to avoid undesirable torques and motion between the orthoses and body .It is also important to realize that most individuals require a period of adjustment or training when receiving an orthoses to achieve maximum benefit (Stein, 2009).

The use of alternative or nonconventional therapies by patients to supplement or complement conventional medical treatments has been common place for many decades. That can be categorized as follows:

1. Biologically based practices - A number of nutritional supplements and herbs have been suggested for the prevention of CVA and related diseases with varying degrees of research evidence.
2. Manipulative and body-based practices - Manipulative and pressure-based therapies encompass any of a number of techniques that involve touching the body with an external object, such as massage therapy, or a penetrating needle, as in acupuncture.
3. Energy medicine – ex.: electrical stimulation TENS
4. Mind-body medicine - This section includes interventions focused directly on cognitive processes that are intended to favorably affect the whole body: Meditation, Biofeedback, Mental Practice/motor Imagery, Optimizing Self-Healing

Through Expectations and Beliefs, The Radiance Technique.

Most alternative therapies will be used in conjunction with other therapies, and the most judicious use of alternative or complementary therapies will generally be as an adjunct to well-established conventional therapies that are considered to be standard of care. In some cases, alternative therapies can be explored when other therapies appear to have run the course of their effectiveness. In many cases, the use of CAM therapies is initiated by patients, and clinicians need to determine how to deal with these therapies. Communication with patients, including an honest appraisal of the evidence base for both conventional and CAM treatments, is the best approach for safely and appropriately using these therapies in clinical practice (Stein, 2009).

Discussions

A stroke can be a devastating event in patient's lives, leaving them with impairments and disabilities that can threaten their independence (Stein, 2009). Stroke patients do recover to varying degrees, although the extent of recovery is dependent upon a number of factors. There is irrefutable evidence that, even though cortical reorganization is an important component of recovery, stroke rehabilitation is necessary for it to occur (Finger, 1982). Our increasing understanding of factors that contribute to cortical reorganization, gleaned through the animal model, including complex stimulating environments and high activity levels, have corollaries in the clinical realm, such as early admission to rehabilitation, intensity of therapies, and task-specific therapies. Depression, comorbid medical conditions, and cognitive deficits may negatively influence recovery by interfering with learning and through disruption of the rehabilitative process. Clearly, rehabilitation, which is both focused and intensive, is essential to ensure maximal recovery achieved post-stroke.

Conclusions

Stroke is a major cause of long- term, physical, emotional and social disability in the elderly, the highest frequency is between 70-79 years (33,59%). Ischemic stroke is more common in males (54,20%) and in the superficial territory of ACM (39,31%). The development of noninvasive diagnostic technique like cerebral- MRI, cerebral-CT, extra and intracranial ultrasound as well as new therapeutic strategies (intravenous thrombolysis) for acute ischemic stroke demonstrates that the lethal cases decreasing at 11,45%. Early neurorehabilitation begins 48-72 h after stroke onset; the intensity of rehabilitation efforts during the first week should be minimal and increased later on.

Acknowledgments

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