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Stroke; Early Physiotherapy? What Content? Proposal of Physiotherapy Content in the Acute Phase (D1 at D14), Part II: Specific to the Patient Massively Injured by the Stroke

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Résumé

Les complications post accidents vasculaires cérébraux peuvent apparaitre évidemment dès les premiers instants, ou jours post AVC, à l'instar des troubles cutanés: hyper pression sur un coté du corps ou du membre (escarre), de la pneumopathie de déglutition, syndrome épaule-main, des troubles thromboemboliques (phlébite), des troubles cardiovasculaires (œdème), des troubles vésicosphintériens (magnifié par la non verticalisation), les troubles psychoaffectifs, les chutes, la dépression, l'amyotrophie musculaire et bien d'autres, compliquant, et rendant sombre le pronostic fonctionnel et apostériori la difficulté du travail du kinésithérapeute d'une part, et la réhabilitation du patient d'autre part. Ce ci montrant à raison l'importance de l'intervention précoce (si pas de contre-indication) de la kinésithérapie, afin d'améliorer le pronostic fonctionnel de sitôt (guider la plasticité post lésionnelle) et maximiser l'emplois des capacités résiduelles restante (plasticité comportementale). Pareil comme le cerveau (brain is time) c'est le temps, le pronostique fonctionnel,

en est lui aussi une question du temps. Car le membre qui n'est pas employé (''use it, or lose it: use it and improuv it'') perd son volume de représentation corticale, au niveau du cortex moteur, qui aurait pu être évitées si la kiné avec une précoce (à contenu scientifique) par posture systémique, passive et analytique (réapprentissage par tâche douce et orientée) tout en introduisant au fur et à mesure qu'on s'éloigne de l'AVC des mouvements actifs, évolutifs (tant en contrainte qu'en durée) en fonction des habiletés du sujet, de la clinique du jour et des efforts de la veille.

Abstract

The post-stroke complications can appear obviously from the first moments, or days post- stroke, such as skin disorders: hyper pressure on one side of the body or limb (eschar), swallowing pneumopathy, shoulder-hand syndrome, thromboembolic disorders (phlebitis), cardiovascular disorders (edema), vesicosphinters disorders (magnified by non-vertical), psychoaffective disorders, falls, depression, muscular amyotrophy and many others, complicating and making the functional prognosis dark and making the physiotherapist's work difficult on the one hand, and the patient's rehabilitation on the other hand. This shows the importance of early intervention (if no contraindication) of physical therapy, in order to improve the functional prognosis immediately (guiding post-injury plasticity) and maximize the use of the remaining residual capacities (behavioral plasticity). Just as the brain is time, the functional prognosis is also a question of time. For the limb that is not used (''use it, or lose it: use it and impregnate it'') loses its volume of cortical representation, at the level of the motor cortex, which could have been avoided if the physiotherapist with an early (with scientific content) by systemic, passive and analytical posture (relearning by soft and oriented task) while introducing as one moves away from the stroke active movements, evolving (as well as in constraint as in duration) according to the abilities of the subject, of the clinic of the day and of the previous day efforts.

Keywords: Stroke; Early Rehabilitation; Intensive Neurorehabilitation; Spastic Myopathy; Neurovascular Unit Physiotherapy Technique

Rehabilitation of the patient on the other hand. This rightly shows the importance of early intervention (if no contraindication) of physiotherapy, in order to improve the functional prognosis soon (guide post-lesional plasticity) and maximize the use of the remaining residual capacities. (behavioral Post-stroke complications can obviously appear from the first moments, or days after stroke, like skin disorders: hyper pressure on one side of the body or limb (pressure sore), swallowing pneumonia, shoulder syndrome. hand, thromboembolic disorders (phlebitis), cardiovascular disorders (edema), vesicosphere disorders (magnified by non-verticalization), psychoaffective disorders, falls, depression, muscular atrophy and many others, complicating, and making dark the functional prognosis and apostériori the difficulty of the work of the physiotherapist on the one hand, and the plasticity). The same as the brain (brain is time) is time, the functional prognosis is also a question of time. Because the member which is not used ("use it, or lose it: use it and impregnate it'') loses its volume of cortical representation, at the level of the motor cortex, which could have been avoided if the physiotherapist with an early (scientific content) by systemic, passive and analytical posture (relearning by gentle and oriented task) while introducing as we move away from the stroke active, evolving movements (both in stress and in duration) according to the subject's skills, the clinic of the day and the efforts of the day before.

Introduction

Every 2 seconds, someone in the world suffers a stroke, bringing the total number of people affected by stroke worldwide to 17 million [1]. Stroke is one of the most common causes of disability, with more than one third dependent on others for care (activities of daily living, ADL), and the number of people having to live with the consequences of stroke is expected to increase over the next 20 years [2], even as stroke mortality decreases [3,4]. Care in the acute period (D1 to D14) after stroke has improved considerably over

the last few decades, but it is widely accepted that our attention must turn to treatments that actively promote recovery and thus the content of rehabilitation in this so-called acute and prognostic period [5-7].

Post-stroke impairments are a leading cause of disability with a growing social impact of disability worldwide. At the same time, our current knowledge of effective rehabilitation treatments is rapidly increasing as indicated by the multitude of clinical trials, systematic reviews, and meta-analyses published over the past two decades. For healthcare professionals involved in stroke rehabilitation, there is little opportunity to keep up with the evolving clinical evidence, and thus there is a potential for a growing gap between the state of the art in stroke rehabilitation research, clinical practice, and decision making. Guidelines and practice guidelines help to bridge this gap if they are systematically evidence-based. Usually written for a specific (national) context, however, they are often not applicable to other healthcare situations in other countries, thus limiting their usefulness elsewhere, which is what we propose in this two-part article, and remains on the broad principle of neurorehabilitation, see figure 1.

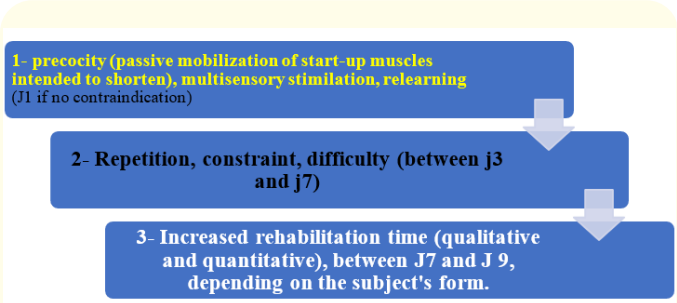

Figure 1: Early rehabilitation scheme.

Post-stroke hemiparesis is "a quantitative decrease in the ability to voluntarily and synchronously recruit motor units to accomplish a desired task" [5,7]. It is due to a unilateral lesion of the primary motor pathway between the originating neuron of the pyramidal pathway and its synapse with the alpha motor neuron in the anterior horn of the cord. A hemispheric, brainstem or medullary lesion may result in contralateral hemiparesis or, exceptionally (if the lesion is located downstream of the decussation of the pyramidal bundle), homolateral to the lesion [5,7,8]. Hemiplegia is most often the consequence of a stroke. Motor impairment is frequently associated with sensory and neuropsychological disorders [8].

Having made a series of arguments in Part I of this article to justify a fairly clear (practical and pragmatic) content for rehabilitators and health care personnel in general, this second part will directly address the bedside clinic.

Rehabilitation clinic, technical gesture

Post-stroke hemi paretic is characterized by: a disorder of command, accompanied by tone disorders (spasticity), and by the presence of abnormal movements (syncinesia). One distinguishes then:

- **"Positive" signs:** Babinski sign; spasticity; spasms; clonus; Synkinetic movements.
- **"Negative" signs:** Muscle weakness; loss of dexterity; fatigability.

Installation

It is artificial to distinguish postural rehabilitation from motor rehabilitation, since it is strongly linked to trunk motor skills. The recovery of walking and transfers, essential condition for autonomy and return to the home, is the priority objective of the care team, the patient and his family. Bobath's rehabilitation strategy (will be validly used in massive hemi paretics, in order to initiate posture and body schema before the plastic behavioral training, see figure 2) is characterized by the simultaneous and coordinated solicitation of posture and movement, composed of: self-turns, acquired as soon as possible; dissociation of the girdles; catching up of imbalances in the sitting position; progressive loading while ensuring good control of the knee; equal distribution of bipodal support; preparation of unipodal support by transfer of support, this last step conditioning the quality and safety of walking. We propose a similar rehabilitation plan during which rehabilitation techniques inspired by the two main concepts and the new approaches described in Part I of this article will be used. All the proposed exercises are to be repeated to improve their quality, as quantity improves quality, see figure 1. The initiation of the command begins by stimulating motor skills proximally with rubbing, percussion and placing techniques, then globally. The proposed exercises are to be performed in bed and then on a Bobath surface; they must be secured by the rehabilitator and with the help of cushions. The initiation of the command can also be facilitated by the use of reactions presented in the 1st part of this article, dealing with the straightening sequences (SDR).

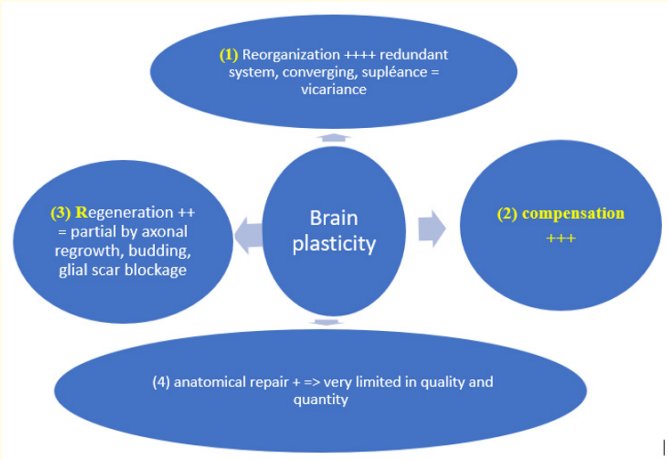

Figure 2: Presentation of the cerebral arrangements (post-injury) known to date by order of frequency (from ++++ to +) and realization. Neuro-rehabilitation (in quantity and specificity of techniques) finds its place around these four poles in order to favor the maximum recovery. Ibrahim Moumeni 2020 [5].

The rehabilitator can perform passive joint mobilizations for 30 to 45 minutes (for a start), which induces a response at the level of the cortical representation of the muscle under the effect of proprioceptive inductions [5-7]. The sensorimotor and cognitive consequences allow an increase in the activation of the primary sensitivomotor cortex after passive joint stimulation, before asking the patient to maintain the joint concerned in a position (transition from passive to active. In terms of plastic reconstruction and recovery, increase of the cortical maps, the active is superior, and more efficient than the passive, hence the interest of not remaining in the passive Bobath).

Dorsal decubitus (DD) setup

Head

- Alignment of the head, neck and trunk on a triangular cushion or raised bed backrest (avoid cervical flexion (F°)), the lumbar F° favors the passage on the flexors, relaxation on the tonic side;
- When the head is turned to one side → Fencer's reflex: tonus is increased on the extensor side and on the flexor side; turning the head to the side of the lesion will promote the passage of tonus on the extensors, and relaxation too.

Upper extremity

The shoulder: the small cushion under the shoulder that promotes relaxation at the tonus level which is the proximal key point. Increased correction of retroposition, postural means.

Subluxation is a frequent problem in post-stroke hemiparetics. It is defined as the loss of congruence of the glenohumeral joint, between the scapula (glenoid) and the humerus (head). It is explained by the anatomy: at the bone level: the 2 surfaces in contact are congruent butdo not fit together; at the ligament level: the ligament system is relatively weak at this level (circumduction); the stability of the shoulder is therefore largely devolved to the tone of the muscles that cross it. During a C.V.A., the muscle tone is abolished during the initial stages (flaccid phase), the muscles no longer support the bony parts => SUBLUXATION.

Aggravating factors

Prolongation of the flaccid period; occurrence of spasticity on muscles having "dislocating" actions on the humeral head; inappropriate manipulations; hemineglect etc... In clinical terms, shoulder subluxation can be scored across the fingers; it can also be objectified by the piston sign (see figure 3). In our experience, there is no curative treatment for subluxation. It is necessary to wait for a possible tonic and motor recovery of the shoulder. However, preventive treatment is very important (where not only an early physiotherapeutic intervention is recommended today, but also a good content, technique and maneuver was necessary, following the example of what is proposed in this article (I and II) are good preventive aids), because it will prevent the aggravation of this subluxation (and its consequences), and facilitate the motor recovery at the shoulder conf fig. The first prevention is an external rotation of the shoulder (see the first part of this article, figure 3). And when a subluxation is already installed, we propose dynamic restraints (omotrain) and not static (sling), immobilizing just the shoulder and not the forearm and arm. This increases the underuse of the joint that crosses the elbow and the wrist. However, they are not dislocated (elbow and wrist), and the consequence would be the decrease of the cortical representation of all its zones not dislocated, but immobilized, then the risk seems for us higher than the benefit conf figure 4.

Figure 3: (A) Hemi neglect; (B) piston sign.

- The upper limb should be as far as possible in extension from the body, with the hand open (sloping if necessary);
- Use of foam troughs allowing the correct positioning of the forearm & hand. Use of large soft objects (sponge). Foam splint excavated with 2 systems: the hand tubing favors the grasp and the mushroom which allows to spread the thumb.

Figure 4: Which shoulder brace? The first two images (A and B) magnify the under-use and increase the coefficient of muscular degradation on the one hand, and put the antagonist still in hyperactivity on the other hand. The first two images (A and B) magnify the under- use and increase the coefficient of muscular degradation on the one hand, and put the antagonist still in hyperactivity on the other hand, which will continue to shorten the antagonist muscle and make extension movements calling upon the opening muscles clinically more difficult [5-10].

The lower extremity (MI)

- The hemi pelvis is lowered and will be raised at its proximal key point to avoid retroposition. The lowering of the hemi-pelvis will promote the passage of tone on the flexors. The knee is slightly flexed to correct the positional recurvatum;
- Put a bolster or a foam boot at the foot of the patient's bed to raise the IM.

Figure 5: TREATMENT by TENS stimulation. Or dynamic orthesis (figure 4): it allows to stimulate the paretic muscles and to help the awakening of the tonus and the motricity. A frequent stimulation of 4 hours (spread over the whole day) per day, when the patient is at rest, allows to invigorate, maintain and prevent the decompensation of the paretic muscles of the shoulder, so it will be better for the patient to have this device at home in order to use it properly if he/she has no associated cognitive disorder. The patient will be trained to use the device by his rehabilitator. NB: the use of the device must be early (from day 1, if possible) to hope for the desired preventive effect [10].

Installation in DL

¾ anterior lateral

- **The head:** Pillow under the head does not generate any worries.
- **The upper limb:** The shoulder of the hemi paretic side, more forward than the healthy side.
- **The forearm in pronation:** Open hand and fingers in extension.
- **The lower limb:** In a walking pattern: hemi paretic lower limb in flexion, supported by a brace and the healthy limb in extension.

¾ lateral post

- **The head:** (Same as the ¾ anterior lateral).
- **The upper limb:** Shoulder free forward; upper limb away from the body in extension resting on the support. The forearm in supination and open hand.

- **The lower limb:** Must be in a walking pattern: hemi paretic IM in flexion in extension supported by a support and the healthy limb in flexion.

Seated installation (massive hemiplegia): Wheelchair

- Adjust the armrest on the hemiparetic side to raise the shoulder.
- Adjust the footrests to better distribute the support surfaces, especially the height to have a good distribution of the seat.
- At the sitting level: avoid sub-crural vasculo-nervous compressions → Hospital chair (Voltaire type: High and short back on pate).
- Properly wedge the hemiplegic MS on the closet side or have it rest on the bed surface → In order to prevent the hemiplegic side from collapsing with the arm hanging down.
- Feet are on the ground, avoid having feet in the void to avoid compression of the popliteal fossa. Inhibition → Inhibition posture, support and self-posture

Upper extremity

- Forward mobilization of the scapula with encompassing grip of the shoulder → Lateral ringing of the scapula.
- Mobilization with elbow grip with a reptilian movement in order to obtain 90°, one should not fight against spasticity.
- Arriving at 90° we will see what happens distally: Take the thumb out of the palm of the hand with opening of the 1st commissure forward and not to the side or take the thenar eminence and spread the whole column of the thumb; In pronosupination creep → As we go along, we will arrive at the chains of KABAT, by lateral diagonal.

Lower extremity

- Place the patient in lumbar flexion as a postural reflex to begin tonus reduction, then use the healthy lower limb in patient-assisted triple flexion.
- Advancing the hemi pelvis forward and lowering the hemi pelvis downward.
- Insert your thumb between the hallux and the 2nd, put the hallux in extension, the footin eversion, knee flexion, knee flexion and hip associated with a lateral hip rotation.

Straightening sequences (RRS): Supine (DD)

Upper extremities (MS)

- Check if the patient is able to manage the paretic arm: lateral rotation, upward thrust at an angle or not, BOBATH diagonal with the objective of breaking the syncinesias.
- Do not forget to reintegrate the head if the shoulder is subluxated before abduction.

Lower extremity (MI)

Support transfer on the HP side with a gluteal bridge. Raise the buttocks by squeezing the rehabber's fist to prevent the knee from going outwards Lift the buttocks and lift the leg on the healthy side → much greater support transfer.

- **Working on the girdle gyration:** Arms straight out. Stand next to the patient to be cautious and have the patient move the paretic side forward to avoid pulling the pathological arm.
- **Reverse quadruped:** Over the edge of the table: Lower limb over the edge of the table, put the arm under the knee and take the patient's kick with the 2 fingers and the thumb "scratch" to give him information. Then ask the patient to raise the foot, raise the thigh, extend the knee.
- Recreate the oscillating phase because for a hemiparetic, it is in extension and adduction: Notion of progression: supine, sitting to standing with the same exercise.

Lateral decubitus: → lower limb

- Lowering of the pelvis, elevation of the healthy side: walking pattern against resistance or in free activity: Raise the foot; Bend the hip; Extend the leg.
- Facilitation guidance; Simple hip; Simple knee; Simple extension.
- Work of lowering the hemi pelvis in lateral decubitus (LD).

Prone position

Lower limb

- Stretch the leg and bend it, first the healthy leg, then the paretic leg continuously until fatigue.
- **Reinforcement:** Push on the hand by raising the thigh, control the action to avoid the fall of the leg; Push on the hand then stretch the leg.

Upper limb

If arm stretched along the body, we will cradle the arm by sliding it on the plane with shoulder abduction and elbow flexion. Then he will be able to straighten, extend the arm on the healthy side to increase the weight on the hemiparetic arm. When leaning on the cradle, the patient carries his healthy elbow in E°, pushes on his arm in order to take support on the hemiplegic side elbow.

On the rise

- Raise the healthy arm forward to support the elbow on the Hemiparetic side.
- The healthy MS is carried at the zenith, the trunk in slight dorsal rotation, the support on the hemiparetic elbow is at the maximum.
- **Quadruped:** Generally, the patient is deported on the healthy side, so we will bring him back to his hemiplegic side and share the body load on the paretic side as well and revive him.
- The patient will swing forward/backward and then sideways; lift the hemiparetic limb and the healthy lower limb and vice versa (diagonal), BOBATH pattern.
- **Work on balancing reactions:** Push on the hemiparetic side, (warn the patient before the action). The quadruped at the angle: remain in support only on the hemiparetic side.

The rehabilitator placed behind the patient, will submit to him destabilizations at the level of the pelvis, to which the patient must react in order not to fall, this automatic reaction will recreate the voluntary scheme by the multiplied involuntary reactions.

- **Heel seat:** Cushion over the feet in case of hypo-extensibility. Arm stretched, in order to do self-inhibition of the upper limb.
- Bend the head, spine forward and ask the patient to push back so that he/she can straighten up and kneel upright.
- **Knee-up:** Shift the patient onto his hemi paretic knee to increase support and increase sensitivity while doing indirect reinforcement by load rebalancing to the paretic limb.
- Shift the center of gravity to the healthy side to obtain an abduction balancing reaction of the hemiparetic lower limb.
- Push backwards, asking the subject not to sit back on the heels, and observe if there is a symmetrical elevation of the arms? Reflex of rebalancing the hands to compensate the center of pressure by the center of mass.
- **Serving knight:** Interest transfer to the hemiplegic side → Support on the hemiparetic knee. The rehabilitator lifts the healthy foot, then in progression, directs it forward, right and left, can the patient keep the trunk straight, the hip in extension support. Is there a balancing reaction with the hemiplegic upper limb?
- **Sit-to-stand gesture:** Stand up crosswise/angled to the side of the lesion (right with right hemiplegic). Lean forward, straighten head and push forward to stand up (arms still extended), rehabber's knee behind patient's knee to avoid recurvatum. Step on the hemiparetic lower limb.

The transfers

TURNAROUND + SIT-DOWN

Turning on the paretic side: The simplest way → Bend healthy leg → pushes on the healthy leg.

→ The patient hooks the hand of the rehabilitator or the edge of the table → pulls himself: The patient must pull himself with his hand, and push on his healthy leg and the rehabilitator helps him → Variant: just ask him to reach far in front with his hand and to turn his lower limb → For the guidance: use the oriented task.

Turning on the healthy side

Stimulate flexion of the hemiparetic lower limb. The patient, with his healthy MS, brings back his HP MS on the side he is going to turn to. Stimulate the detachment of the head and shoulder HP at the same time and then their advancement.

Sitting from a lateral decubitus position on the hemiparetic → side Most difficult

Bring the legs back outside the table → Lean forward, then take support on the hand and go up little by → little Sitting down from a lateral decubitus on the healthy side: Bringthe lower limbs outside and make the pelvis inclined on the right side → Stimulate the advancement of the hemiparetic shoulder, take off the other shoulder, go forward so as to put the weight forward, on the elbow (possible counter-pressure of the reeducator on the elbow); at the end the patient pushes on his hand.

Sitting →

To be worked on the Bobath plane with ± cushion behind and/or on the sides. Good sitting position: Patient sitting against cushion, → encourage him to press on his hemiparetic side: Put in neutral position → Think of advancing the hemiparetic upper limb.

Work on parachute reactions and body weight transfer will also be important:

- Hitting targets in a healthy area, then going to the paretic side.
- Work of the parachute reactions → by going to seek a target, to exceed the point of rupture → the reeducator must be well placed to receive the patient.

Upper limb work touching targets

Ensure that the patient extends the elbow; often he compensates by moving the trunk forward, → crushing a ball in the back.

Work with both hands (bimanual tasks) Lower limb work:

- **Extension chain:** The patient must slide his heel away from him on the ground without his foot going into an equinus = soliciting the lifters.
- **Flexion chain:** The patient must crush the hand of the rehabber with knee to avoid the triple flexion when the patient brings his foot closer to him by sliding the heel on the ground.
- The double task allows the automation of the task, to be acquired as early as possible.

Sitting - standing + chair transfer

Sitting on the edge of the table →, the physiotherapist guides by the following actions

- Solicited the transfer of support on the HP side by asking him to push his hemiparetic trunk against a resistance.
- Solicited the advancement of the hemiparetic limb by asking to push on the knee.

Sitting - Standing: Start on high seat

- The hemiparetic foot is always advanced, ask him to move his foot back via the healthy lower limb.
- Ask him to bend forward while looking at the target to extend the neck and then straighten up.
- Lower seat.
- **Same as sit-stand:** Move forward with buttocks on the edge, feet in good position, lean forward, head extension following the target and then straightening up → The reeducator is homolateral to the paretic side for safety.
- **Variation:** Upper limb in position of inhibition, make him touch a target which makes him lean forward.
- **Progression:** Lowering the height of the seat; reducing the weight on the non-paretic side or even without support on the healthy limb.
- **To bring the weight on the hemiparetic side:** The physiotherapist guides by bringing it closer to him, give a target that is on the paretic side, put the healthy foot either on an unstable step/peg or further forward

Sitting - sitting on another seat that is on the healthy side Pivot transfer

- **Preparation:** Move forward to the edge of the seat, feet at the same level + bring the feet closer together in the direction of the seat + safety: brakes, remove the feet from the footrest... Support with healthy upper limb on the armrest
- Leaning forward, pushing on the lower limbs, looking up at a target, the target rotates to make the patient turn.

As the hemiparetic progresses, the assistance is gradually withdrawn, or even made difficult, because difficulty and fatigue are factors of plasticity [6-8].

By passing through a standing position → the patient takes small steps to reach the armrest

Sitting - sitting on another seat that is on the paretic side

If it is impossible to reach the armrest, the healthy hand will therefore take support on the starting seat. It is → possible to lift the paretic leg to pivot on the healthy side.

Standing: transfer of support to the hemiparetic side

- **Control of the good position**: Active axial extension, no recurvatum = compensations → The patient comes to counter the resistances of the reeducator (the reeducator increases the resistances according to his feeling (The resistance should not be too dosed by the reeducator, at the risk of demotivating the patient, nor too light, at the risk of returning the useless session. The right balance must be found by the therapist to motivate the patient and obtain a gain from the session).
- Targets → the patient touches with his healthy hand, but in the hemiparetic field (diagonal).
- → Search for parachute reactions (use of body weight support) → Position the hemiparetic lower limb forward = lunge (functional = walking) + target or pick up an object on the ground (on this action, the therapist must be vigilant and secure knee and control the balance and probable falls).
- Tandem position → Work on the passage of the step → The hemiparetic lower limb remains on the ground, it is the healthy side which goes forward: Either by requesting a target for the → upper limb Or by putting a target for the lower limb → Obstacle on the healthy side = increase of the time in the phase of simple support; increase of the distance also.

Work on the oscillating phase

- Put an inclined plane, the patient puts the heel on the inclined plane, must slide the heel on the plane while keeping the toes raised.
- Possible tape or straight line marking to avoid mowing. Limit the elevation of the hemi pelvis (HB) → work with a skateboard
- **Progression:** Increase the distance and height of the steps, start with the footbackwards
- **Compensation:** The trunk moves in one piece when the leg goes forward, the trunkgoes backward and vice versa.

Facilitation and guidance

Starting from an inhibitory pattern → spastic pattern according to the protocol in order to work the weak muscles, to slow down and control the muscles in the beginning of spasticity: Do the movement → Stop the movement → Continue the movement.

Upper extremity (EM) work and control

- **Exercise 1**: Sitting with support on the hemiparetic MS, shoulder controlled by the physiotherapist, the patient performs small isolated movements of the elbow, the physiotherapist can increase the resistance if necessary.
- **Exercise 2**: Sitting with both MS stretched in retropulsion, the patient performs gentle "push-pull" movements against the rehabber's hands.
- **Exercise 3**: Patient in dorsal decubitus (DD) or lateral decubitus (DL). The patient with the paretic arm stretched to the zenith will push against the therapist's hand, or against a wall in several directions, thus realizing a mobilization of the shoulder girdle, this in supination-external rotation of the shoulder or in pronation-internal rotation of the shoulder.
- **Exercise 4**: From the DD by important and sustained push on the hand of the therapist, the patient by support will involve a rotation of its scapular belt and will facilitate its passage on the DL and even lead to the passage on the belly.

Lower extremity (MI) work and control

- **Exercise 1**: We will start by lifting the pelvis, knees in hook and then later with the help of the paretic lower limb only, if the intensity of the exercise increases we obtain a rotation of the pelvic girdle, which allows him to turn on the side and even arrive on the stomach.
- **Exercise2**: In ¾ lateral, facing a wall the hemiparetic patient moves his paretic MI up and down realizing a flexion and an extension of the knee.

Walking rehabilitation

Gait Defect of a Hemiparetic Postural Control Defect: →

- Inequality of the two oscillating phases, long on the paretic side, short on the healthy side, by dodging the support on the paretic foot. This asymmetry is generally due to the shorter and briefer half-low on the paretic side, the reduced swing speed of the paretic limb, the longer weight-bearing time on the healthy side, and the increased duration of the

double swing support (transfer time from the paretic to the healthy side); and the gait speed is correlated to the quality of recovery.

- Retropulsion of the paretic hemi-body, which gives the impression of being "dragged" by the patient; Posterior stepping and girdle dissociation; Limping.
- **Defects in joint positioning and control:** Foot positioning defect, which can have several origins (among others): Deep or superficial sensory impairment at the foot; Consequence of agonist muscle spasticity.
- The retracted spastic varus equinus foot or dystonic foot, associated with the rotator cuff, levator and eversion muscle deficits, is responsible for the lower limb being supported on the ground by the outer edge; support of the lower limb in extension/rotation at the hip.

Recurvatum of the knee, which may be due to

To the lack of control of the other joints of the lower limb in a closed chain; To the support of the foot on the ground in equine varus of the foot; To the important spasticity of the antagonist muscles; To the deficit of the control of the ischio-leg in the last degrees of extension in the oscillating phase; To the defect of proprioception; Deficit control of the hip: The muscular imbalances most often lead to a support of the lower limb in extension/Medial rotation at the hip. In addition, the insufficiency of the hip flexors does not allow a good advance during the oscillating phase.

Walking must be done in quantity to hope to increase speed. In this acute phase, it is important to start stretching the muscles that are prone to shortening: anterior rectus, gluteus maximus, soleus and gastrocnemius, figure 6 (and see figure 2 and 3 in the first part of this article). The quality of walking should not be solicited by the rehabilitator any time soon, because quantity will automatically lead to quality over time.

Dissociation of the belts

- **Exercise 1**: Initiation with a Klein ball placed under the patient's legs, lower extremity (MI) flexed on it, the therapist rotates the ball to the sides;

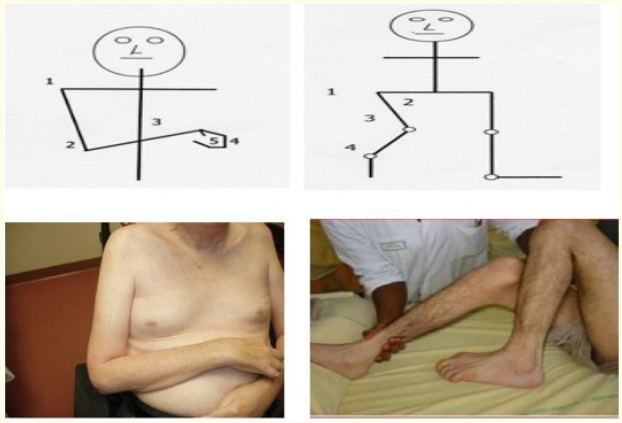

Figure 6: Natural musculo-functional dystonia pattern towards chronicity if early rehabilitation is not initiated.

- **Exercise 2**: Belt gyration: same exercise as above but with the IMs on one side and the upper limbs (ULs) starting on the other;
- **Exercise 3**: Active motor dissociation: MI in hook, the patient must learn to control the abduction/adduction of his hips, with the knees glued together. This exercise is done with the help of the therapist at the beginning, then alone, then against resistance and external force which must increase towards intensive training [5-9].
- **Exercise 4**: A workout on a rotating stool;
- **Exercise 5**: Military march with the knees raised high. The left hand comes to rest on the right knee. Then, the other way around.
- **Exercise 6:** Walking while crossing and picking up objects on the ground. → Control of the oscillating phase: During this phase, the patient tries to lower the time of the unipodal support on the hemiparetic side. The limp is therefore due to the multitude of speeds between the oscillating steps slowed down on the paretic side and accelerated on the healthy side.

Purpose

To make the patient aware of his limp: tell him during his walk: bend the knee more, try to keep the pelvis straight, raise the toes.

These instructions are sometimes very therapeutic. In our experience, some patients do not even know that their walking pattern can improve right after they become aware that their walking steps are pathological.

Triple flexion lower limb advancement: In the case where the patient is walking with retropulsion of the paretic hemisphere and without hip and knee flexion, the therapist can attempt to correct this with the following exercises and instructions

- **Exercise 1**: Place a resistance-guide on the front of the hemipelvis (HB) when walking;
- **Exercise 2**: Rise from the knee in front of the espalier;
- **Exercise 3**: Heel-buttock succession;
- **Exercise 4**: Perform the military walk on the spot;
- **Exercise 5**: The patient, in profile to the espalier where there are markers, must perform a global flexion of his lower limb in order to position his foot at the level of one of the markers.

Attack by the heel

→ The preparation of the taligrade phase can be improved by asking the patient:

- **Exercise 1**: To place his heel on a step, placed at approximately 15 cm of his feet, where a foam ball is placed to be crushed;
- **Exercise 2**: To place the heel on marks inscribed on a triangular cushion placed in front of him;
- **Exercise 3**: To position his foot on the ground on marks according to a hemi-clock, on the hours suggested by the MK, with return to the starting position between each movement.

Control of the support phase

During this phase, rehabilitation will focus on the lack of support, the global postural deficit of the hemiparetic lower limb, and in fact all the joint malpositions and vigilance defects. The quality of the support on the ground is a determining factor for the safety of the walk.

Improvement of unipodal stance time on the paretic lower limb

The patient must be able to hold unipodally for 7 seconds to optimize the safety of his walk, and for this:

- **Exercise 1**: Hold unipodally on the hemiplegic MI in front of the espalier;
- **Exercise 2**: Knee fight with the physio;
- **Exercise 3**: Stepping (with a step of 8 cm height). They are useful to train the extensors of the paretic lower limb to work together concentrically and eccentrically and improve unipodal support.
  - Climb up and down the step in front of him starting with the healthy foot, this associated with a station of a few seconds at the top of the step;
  - Same exercise with the step placed laterally;
  - Same exercise with the step placed behind him. The patient should start climbing with the healthy foot and then with the paretic foot.
- **Exercise 4**: The patient stands with the paretic foot on a scale and the healthy foot on a moving tray.

Hip control

The therapist can improve hip control in all three planes

- **Exercise 1**: Gluteal bridge over the paretic foot;
- **Exercise 2**: Kneeling upright, unipodal or walking with knees upright to avoid having to control the underlying joints.

Knee recurvatum due to lack of proprioception

- Attention must be paid to the recurvatum of the paretic lower limb, which increases the retroposition of the hemi pelvis (HB) and the risk of falling by sliding of the knee.
- The control of the knee position in the last degrees of E° will be improved by different sensitivomotor exercises:
  - **Exercise 1:** The patient in unipodal facing the therapist sitting on a stool must realize a F° then an extension of the knee without putting in recurvatum, by the verbal and manual guidance of the physiotherapist;

- **Exercise 2:** The patient in lunge, with the same control to realize;
- **Exercise 3:** The patient upright with a skate under the paretic foot must move it in front and back by controlling its knee in phase taligrade.

Foot positioning defects

Spasticity can actually impair the quality of walking,

- **Exercise 1**: the physiotherapist positions a tray under the paretic foot and asks the patient to touch it: In position 1 with the heel; → In position 2 with the sole of the foot; → In position 3 with the base of the metatarsals; → In position 4 with the toes;
- **Exercise 2**: The standing patient must place his paretic foot on a Freeman plate, with a progressively greater support, and switch it from the inclined position to the horizontal position. He must control the position of his ankle, which will go from dorsal flexion to plantar flexion;
- **Exercise 3**: The patient, seated on the edge of the table, with his bare HP foot on the ground on a strip of different materials (gravel, carpet, sandpaper, etc.), must recognize the different textures by pressing on the sole of the foot.

Lunge exercise

This exercise is useful because it uses the patient's balancing skills and requires supporting translations.

- **Exercise 1**: The lunge with the paretic lower limb placed behind improves recurvatum control and propulsion. The therapist is placed behind the patient and performs a stop with his knee when the patient performs extension;
- **Exercise 2:** The lunge with the HP MI placed in front improves mR awareness of the knee and hip;
- **Exercise 3:** The support translation from front to back improves dynamic joint control.

Walk

Once the walk is secured, with more or less reduction of the defects, it can be optimized at different levels:

- **Exercise 1**: To improve double-task walking, which will help reduce the risk of falls by diverting attention, the physiotherapist can train the patient to walk with the occurrence of unexpected elements (plop, foam), or (sound) such as sudden noises, slams, a ball thrown in front of him.
- **Exercise 2**: Walking with weight in both hands and bent knees;
- **Exercise 3**: Sideways steps with obstacles;
- **Exercise 4**: Walking with resistance applied by the therapist;
- **Exercise 5**: Walking with sudden changes of direction and half-turns;
- **Exercise 6**: Walking on a line (balance work).

Stairs

Stairs are an obstacle to overcome because going up and down them is necessary for the patient's independence. In addition, it is an excellent exercise to complement the quality of weight transfer as the support must be balanced and long enough to properly place the other lower limb on the next step.

The floor lift is also a good overall training exercise. While asking the patient to lie down on a mat on the floor by himself, and time the time he spends getting up. The patient should try to beat his own record every three days. Because the time spent on the ground after a fall is characteristic of poor recovery and poor functional prognosis.

Climbing

The patient must be able to achieve a triple flexion of the paretic lower limb, sufficient for the height of the walk. During the translation of the weight, he/she must achieve a progressive extension without retroversion of the pelvis and the trunk. During the ascent of the healthy lower limb, the patient must maintain a stable and sufficiently long unipodal support.

Descent

The easiest way is to lower the lower limb onto the bottom step, but when lowering the healthy IM, it must remain in extension.

	Middle cerebral artery (A) (= Sylvian)		A. anterior cerebral	Posterior cerebral A.
	A. right	A. left		
Superior Territory	Left brachiofacial sensitivo-motor hemi paretic (HP)	Right brachiofacial sensi-tivomotor HP HLH	HP predominantly in the lower limb (MI) sensitivomotor	HLH contralateral to the lesion (visual area) Visual agnosia
	Homonymous lateral hemianopsia (HLH) Unilateral spatial neglect (USN)	Aphasia	Frontal or dysexecutive (Σ) syndrome Aphasia if left	
Deep territory	Massive proportional HP, Ø sensitive (pure motor) im-pairment; Involves the entire hemicorpus			Sensitivity disorder of the opposite hemisphere Spontaneous pain, dysesthesia...

Table 1: Clinical and associated disorder.

In the case of a straight HP	In the case of a left HP
Aphasia; Apraxia by production disorder; Acalculia.	Hemineglect Anosognosia Hemiasomatognosia Apraxia by body disorder Attention deficit disorders
In both cases	
• Memory problems • Emotional and personality disorders • Σ dysexecutive	
›Which lobe? Which function? Parietal : Somesthetic Occipital: Visual Frontal: Motor and cognitive Temporal : Hearing and memory. NB: Be attentive to the unmasking of probable signs during the first hours of rehabilitation, because this can already allow to consider a functional prognosis at d 24 hours of the stroke. Please refer to the brakes of rehabilitation in part I of this article.	

Table 2: Associated and specific disorder in each hemisphere.

Conclusion

For early detection and the notion of functional prognosis in the acute phase (day 1 to day 14), it should first be noted that everything depends on the type of stroke. Because we know today that early medical intervention (less than 3 hours) after a stroke, is determined not only in stopping the race to the deterioration of neurons (inflammation), but also to limit the inflammatory period, and to allow the neurons not totally affected to heal, and to recover as soon as possible in function by means of post lesion plasticity. However, interventions that are more than 6 hours apart

can sometimes have functional consequences that are difficult to recover afterwards in view of the very large number of neurons damaged by inflammatory overflight. Other ingredients of the early functional prognosis is the type of stroke; the hemorrhagic stroke as a whole is functionally and vitally deleterious than the ischemic stroke. Also, the clinician who has to announce the functional prognosis to the patient and/or family must take into account the age of the individual (which is related to pre-injury plasticity), comorbidities. Motivation and mental availability for re-training which is linked to plastic behavior (which can be a real source of lifelong recovery), while not forgetting that the best recovery in the first two weeks is clearly an image of the functional prognosis in the following days, because patients who recover less well in the first two weeks will recover less well in the following months. Complications can appear obviously from the first moments. Early physical therapy is nowadays highly recommended, and the content we propose is feasible and tolerable by patients in the acute phase. But the intensity will depend on the clinician, the therapist, and especially on the patient (age, type of injury, region affected, medical record and intervention etc...), and his or her day shape, each patient being unique, the protocol of x will not necessarily work with Z, hence the experience of the reeducator must show ingenuity. Nevertheless, the fundamentals, the technical approaches, postural, sequential and manual attacks and strategic instructions remain the same, as they emanate from our multiple clinical experiences acquired within the neurovascular units.

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