



Stroke. Early Physiotherapy? What content? Proposal of Physiotherapy content in the acute phase (D1 to D14) part I

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Stroke; Early Physiotherapy? What Content? Proposal of a Physiotherapy
Content in Acute Phase (D1 to D14), part I.
AVC; Kinésithérapie Précoce? Quel Contenu ? Proposition d'un Contenu
Kinésithérapique en Phase Aiguë (J1 à J14).

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Résumé

La médication par l'exercice physique en phase aiguë (J1 à J14) de l'AVC ne doit pas être négligée, au dépend de la médication chimique ou actes médicaux. Car, comme le pronostic vital, le pronostic fonctionnel doit aussi être précocement sollicité par les médecins en générale, et ceci dès la phase aiguë (J1, si pas de contre-indication). De ce fait, La kinésithérapie a un rôle prépondérant dans la prise en charge initiale du patient, qui va permettre de conditionner sa récupération fonctionnelle à court et à long terme. Le grand principe de la rééducation physique à ce stade, est d'influencer au mieux le phénomène de plasticité cérébrale (naturelle et comportementale), afin d'initier une récupération la plus fonctionnelle possible de sitôt. Ceci notamment grâce à une prise en charge précoce, stratégiques, provocatrices de légères difficultés, progressive en intensité en fonction de chaque patient, de l'âge, et les dispositions pré-lésionnelles. Les objectifs à cette phase vont être d'abord la prise de conscience des fonctions lésées, et de l'apport, effort personnel du patient (dans sa récupération motrice), la récupération des fonctions perdues : équilibre, marche, préhension, trouble cognitif, etc... (Ce qui impactera immédiatement sur la dépression et mettra en confiance le patient). Le but est de permettre au patient d'acquérir une autonomie la plus rapidement possible d'une part, et d'empêcher l'installation du syndrome (phénomène) de sous /hypo utilisation nocive d'autre part (plasticité mal adaptative). Face à la diversité des tableaux cliniques rencontrés à cette phase, tant au niveau des symptômes, qu'au niveau des capacités de récupération, il s'agit pour le thérapeute d'un réel travail d'adaptation et d'ingéniosité de médication par les exercices physique et thérapeutique. De nombreux paramètres influencent la récupération à ce stade ; donc la précocité de la reprise d'activité, les répétitions, la contrainte, et la quantité de temps dévoué à la clinique rééducative. Par ailleurs une intensité trop élevée est nocive pendant ces 14 premiers jours. Il faut s'ajuster aux capacités de chaque patient, et exploiter le moindre mouvement visible, ou provoquer sa visibilité (par les reflex archaïques, mouvements automatiques, non volontaires) pour les traiter par le mouvement amplifié (thérapeutique du mouvement par le mouvement pour le mouvement). Il existe dans la littérature de nombreuses techniques dédiées à la rééducation de l'hémi-parétique : méthodes neuro-facultatives, théories d'apprentissage moteur, imagerie mentale... En pratique, certains concepts sont plus couramment appliqués que d'autres. Cependant, il apparaît que peu d'entre elles ont significativement fait leurs preuves quant à leur application en phase aiguë. D'où le contenu de kinésithérapie pendant cette phase méritait d'être abordé, discuter et proposer dans la littérature. Au regard de nos multiples expériences acquises en neurorééducation du mouvement, et médecine physique et réadaptation en générale, tant en phase aiguë que chronique, cette étude apporte des concepts pratiques et nécessaires au contenu, le bol même de la kinésithérapie durant les 14 premiers jours dit aiguë de l'AVC

Abstract

Medication through physical exercise in the acute phase (D1 to D14) of stroke should not be neglected, at the expense of chemical medication or medical procedures. Because, like the vital prognosis, the functional prognosis must also be requested early by doctors in general, and this from the acute phase (D1, if no contraindication). As a result, physiotherapy has a preponderant role in the initial care of the patient, which will make it possible to condition his functional recovery in the short and long term. The main principle of physical rehabilitation at this stage is to best influence the phenomenon of brain plasticity (natural and behavioural), in order to initiate the most functional recovery possible soon. This in particular thanks to early, strategic care, provoking slight difficulties, progressive in intensity depending on each patient, age, and pre-injury arrangements. The objectives at this phase will be first of all the awareness of the damaged functions, and the contribution, the patient's personal effort (in his motor recovery), the recovery of the lost functions: balance, walking, grip, cognitive impairment, etc ... (which will immediately impact on the depression. The goal is to allow the patient to acquire autonomy as quickly as possible on the one hand, and to prevent the installation of the syndrome (phenomenon) of under / hypo harmful use on the other hand (poorly adaptive plasticity). Faced with the diversity of clinical pictures encountered at this phase, both at the level of symptoms, that in terms of recovery capacities, it is for the therapist a real work of adaptation and ingenuity of physical activity and therapeutic. Many parameters influence the recovery at this stage (precocity, repetitions, stress, and the amount of time devoted to the rehabilitation clinic) moreover an intensity +++ is harmful during these first 14 days. You have to adjust to the abilities of each patient, and exploit the slightest visible movement, or cause his visibility to treat him by the amplified movement (movement therapy by movement for movement). There are many techniques in the literature dedicated to the rehabilitation of hemiparetic: methods neuro-facultative, motor learning theories, mental imagery ... In practice, some concepts are more commonly applied than others.

However, it appears that few of them have been significantly proven for their application in the acute phase. Hence the content of physiotherapy during this phase deserved to be approached, discussed and proposed in the literature. In view of our many experiences acquired in neuro rehabilitation of movement, and physical medicine and rehabilitation in general, both in acute and chronic phase, This study provides practical concepts necessary for the content, the very bowl of physiotherapy during the first 14 days of acute stroke.

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

Introduction

Stroke is "a sudden deficit in focal brain function with no apparent cause other than vascular". Stroke occurs when the flow of blood to the brain is abruptly interrupted, depriving one or more parts of the brain of oxygen. Causing them to malfunction, then death (within minutes) of the nerve cells and at worst the death of the individual. Affecting approximately 150,000 new patients each year in France, stroke has an incidence rate that doubles every 10 years after the age of 55; 25% of strokes occur in people under 65 years of age (i.e. in the working population), and more than 50% in people 75 years of age and older. After a first stroke, the risk of recurrence is significant, estimated to be 30 - 43% at 5 years [1,2]. Stroke is the leading cause of motor disability, the second leading cause of dementia, the third leading cause of death in men and the first leading cause of death in women. It can be ischemic (> 80%) and hemorrhagic (< 20%) [1-3]. It is a medical emergency, and calls for immediate intervention, at best in an adapted structure (neuro-vascular unit, UNV). The physical therapeutic treatment remains the same as for ischemic or hemorrhagic lesions and must immediately precede medical treatment (when the vital prognosis is no longer considered, and the contraindications are removed). After the accident, three phases can be distinguished: The acute phase which concerns the first 14 days, the sub-acute phase, from the 14th day to the 6th month, and the chronic phase, after 6 months. The course of treatment varies according to the patient, but hospital management from the first symptoms is of vital importance. Because rehabilitation is so important after a stroke, the most common question about the ideal time to start active physical therapy is not well resolved [1-4]. While the current trend is to begin physical therapy at a very early age, either on the day of or the day after the stroke, there is considerable evidence that there is a clear benefit to be gained from the use of special teams (physiotherapists, neurorehabilitation specialists) for stroke management [4-7], and in Short- and long-term benefit on mortality and independence [4,8]. The actual content of acute physical therapy from D1 to D15 D1 to D14 remains to be fully defined. Since the literature is silent on this subject, we propose in this study to establish the need to reinforce early treatment, to launch a study of its content, with scientifically proven objectives, in view of the bibliography and the clinical situation [3-5,11,12].

Time is Brain! Neurological recovery "usually" begins after a few days (if advanced medical treatment is provided in quality and quantity as quickly as the onset of the tragedy and the end of the inflammatory period) after a stroke. This process is based on two

pillars: the first is the removal of hypoxia from an area, known as the ischemic penumbra, presenting functional suffering, without permanent neuronal lesions. This mechanism is primarily influenced by the early onset and quality of stroke care, which is best provided in intensive stroke units. The second mechanism (the one that early neurorehabilitation is imbued with) is that of brain plasticity [4], to compensate for neuronal death, if it is not too extensive. Some surviving neurons can modify their activity, notably by creating new connections by developing dendritic and axonal networks. It seems to us that the most efficient of these plasticity mechanisms is the one involving the neurons adjacent to the lesion. They develop in a few days or weeks at a distance from the inflammatory period, and it seems more efficient than the earlier, but less perennial, mechanism that will bring into play a control-plasticity in the healthy hemisphere.

For the mechanisms of cerebral plasticity to be effective, the central nervous system (CNS) must be stimulated in a way that is related to the neurological objective [1,2,4,5]. This is the foundation of stroke rehabilitation, which has revolutionized its approach over the past 30 years. It should be remembered that rehabilitation emerged from a period in the 20th century when the fatality of injuries and the desire to protect "what remains" were at the heart of rehabilitation. The latter was essentially focused on the prevention of secondary complications and the development of functional compensations through rehabilitation and not re-education (recovery).

The hypo-mobilization/under-utilization in short position of certain muscles in the context of paresis of opposite muscles, is accompanied by a loss of their longitudinal tension. This loss of tension is the first step in a series of cascades and genetic, structural, biomechanical, then physiological transformations of hypo-mobilized or under-utilized muscles. Including, among others, a loss of their extensibility, their length and an increase in non-extensible collagen. In the subacute and then chronic stages of the syndrome, neurological and muscular disorders coexist together, and even seem to be mutually supportive [4,5]. Tardieu, *et al.* and Tabary, *et al.* [7,8], in 1972, were already talking about the influence of immobilization on neurological pathology just after a few hours of immobilization in the short position in the animal model. These authors observed myotatic contracture, characterized by a change in passive tension, on the transverse extension curves of the muscles. These changes are associated with a considerable decrease in the number of sarcomeres, and a tetanic spasm observed by EMG

(electromyography) on the solars. These phenomena had also been observed by Gioux and Petit (1993 and again in 2005) [9,10]. All these authors unanimously describe an increase in the collagen rate and connective tissue, inducing genes that promote atrophy and stiffness. A 37% decrease in the fractionated rate of protein synthesis (on the 14th day of immobilization) and a 30% decrease in the loss of muscle mass. Myofacial thickening was also observed, as well as an increase in the proportion of inter and intramuscular fat. With an increase in mRNA content for components of the Ubiquitin-proteasome system, associated with a 15% decrease in muscle strength already at the second hour of immobilization, and resistance to passive stretching from the 18th hour of immobilization [4,5,7-10]. In view of the ultra-early muscle pathology, physical management must also be based on the prevention of these shortening observed by the above-mentioned authors. Thus, the posture must precede medical management by extension postures, eccentric rotation of the muscles, so we know from experience that they are generally the target of neuroorthopedic complications (See figure 2 and 3).

Fundamentals, clinical instructions for first contact and initiation of physical therapeutics

Early physiotherapy finds its importance and its objectives (Figure 1) between D1 and D15 in a work of prevention of complications which can appear early: orthopedic complication by muscular retractions on an early spasticity, bronchial congestion by swallowing disorders and hypoventilation related to decubitus and deficit, deep venous thrombosis and constipation in particular. Passive physiotherapy using limb mobilization and long postures on certain target muscles (Figure 2 and 3) and active but not dynamic physiotherapy will also be used during the two weeks following a stroke. According to our daily practice [4], it is well tolerated, which is corroborated by Bernhardt, *et al.* [14]; Quin TJ., *et al.* [15]; Baron JC., *et al.* [16,17]. Muscle retraction is most prevalent in the muscles most affected by stroke (Figure 2) and is promoted by insufficient passive mobilization and "unconscious" positioning in a short position in a paresis rather than a pliege.

In this panoply of guidelines, the clinic must dominate. The educator will choose and adapt his observation and approach to the state of the patient and the objectives (See figure 1) that he wishes to achieve in the first 15 days (based on a rigorous evaluation beforehand). In the patient who is flaccid or has significant

motor weakness, postural activity must be increased using tactile and proprioceptive stimulation, with the utmost caution as this can rapidly lead the patient from a flaccid state to a state of spasticity.

This can be avoided by associating reflex inhibition schemes with tactile stimulation of progressive intensity, so that motor responses remain controlled and of normal tonic value. What should also be known is that a patient who has just had a sudden hemiplegia loses control of his hemicorps (which can often be the dominant side) completely and instantaneously, there is a rupture of both parts of his body, the body schema is altered. He will lack postural reactions and balance on his upper and lower limbs. The patient is afraid of falling, which increases his tone which also becomes abnormally regulated. The patient is confused, disoriented and sometimes ignores his affected side.

It is important to preserve the hemiplegic shoulder before any rehabilitation treatment.

Other recommendations, always ensure the free mobility of the scapulo-thoracic before any mobilization of the hemiplegic shoulder. Before any opening of the first corner of the thumb, it is imperative to reduce the flexion position of the wrist. Key point inhibition postures that are too static and stereotyped must be used on an ad hoc basis and must be abandoned very quickly. Avoid the systematic use of the upper limb inhibition posture. Once spasticity has been inhibited, consider releasing the distal key point to the detriment of fingertip or toe tip guidance. Do not walk the hemiplegic patient until control of the lower limb is achieved in a supine, seated position. Always mobilize the scapular belt before mobilizing the glenohumeral. To allow the patient to obtain a better gestural activity: More functional, faster, repetitive and more efficient action. Improve support and parachute reactions on the hemiplegic side. To improve the gait pattern: A better anterior step, oscillating phase and posterior step (improve the height, length of the step and carrying step).

Increase the walking perimeter, step speed and consider the different types of walking. It will also be a question of breaking abnormal syncinetic/dyskinetic patterns in order to regain adapted and coordinated motor activities, in order to prepare the patient for precise functional activities. Initiate an adapted and automated postural activity, as this is the imperative support of voluntary movements and statokinetic balance. The exercises will be done

with less and less help. A hemiparetic of 20/30 years old is a potential coxarthrosic in the near future (think about techniques to strengthen all the gluteal and hip muscles after the acute phase). Indeed, the distribution of the supports is essential, it is necessary to preserve its healthy side too often used... Respect the patient's fatigability, intersperse the exercises with moments of rest but also with soft and relaxing mobilizations, an active axial extension associated with a wide and deep breathing can be very useful for the treatment of the hemiarthrosis (12).

Clinic: First approach (if no contraindication for verticalization)

Installations in bed and chair: The trunk is straight, the feet resting on the footboards correctly adjusted in height, the knees spread apart often maintained in abduction by a small cushion, the buttocks rest on an anti-decubitus cushion. The upper limb is suspended by sling and gallows or maintained in a fitted and raised armrest without omitting to place it in relation to the visual field of the patient favouring the cortical integration of the limb too often neglected. For safety, the patient can be strapped to the chair by means of an abdominal and clavicular strap designed for this purpose.

The wrist and hand are in the functional position, the hand open with the thumb apart in order to maintain a pattern of inhibition. In decubitus position, the patient is positioned with the upper limb away from the body and raised on a pillow, if possible in a sloping position. The lower limb is moved slightly apart and positioned in slight flexion so as to suppress the recurvatum effect and inhibit spasticity of the quadriceps. The foot is held perpendicular to the leg segment by a bolster and raised by a pillow so that the heel does not rest on the bed plane (there are anti-shin and heel support foam boots available).

The head must be realigned with the rest of the body.

In lateral decubitus position on the healthy side or on the hemiplegic side, the patient is in a walking pattern with the lower limbs, one in flexion held by a cushion, the other on the bed plane in extension and this in an alternating manner. The hemiplegic upper limb on the affected side is free at shoulder level and is in full extension, forearm in pronation and the hand open. On the healthy side the upper limb is in full extension in the same position as before, held by a cushion.

Verticalization; and posture

The first verticalization must imperatively be done with the medical team.

Always seated on a chair in front of a figure (prefer sitting postures to lying down if there is no contraindication: Functional dominant in bed rest (attention, bad prognosis of the trunk): Practice of pelvis raising, lower limbs in hook, the therapist fixes the patient's feet on the bed. The patient lifts his pelvis and thus goes back up to the top of the bed without shearing phenomenon. The patient learns how to turn over on the hemiplegic side and on the healthy side with the help of a gyration of his scapular belt, added to the inertia of the upper limbs stretched vertically. Learning of the lateral decubitus transfer on the healthy side to the sitting position with the help of the healthy upper limb to support oneself, added to the straightening of the head and the cradling of the hemiplegic lower limb by the healthy lower limb. Sitting, standing and chair transfers are carried out by the therapist, leaving the patient to manage as much as possible, remembering that the patient has a good side and must manage his handicap as well as possible, of course in the best possible conditions. The therapist is placed either in front of the patient or on the side of the hemiplegia, from the sitting position the patient in self-inhibition to the upper limb leans forward (hips and trunk forward), straightens the head and stands up by pushing on his feet, the therapist must control the hemiplegic knee (tendency to recurvatum), the passage of the support on both limbs must be efficient, the patient performs a transfer by pivoting on both feet and sits down in progression as he got out of bed.

Mobilization (postures and inhibition)

Do not pull on a triceps overall if the lower limb has been positioned in triple flexion, from this starting position start again towards the extension by posturing the triceps in a classical way to facilitate the relaxation of the upper limb, it is enough to move the thumb (1st commissure) away from the other fingers. For more efficiency it is also possible to abduct the other fingers of the hand, by interposing the fingers of the rehabilitator between those of the patient. The patient practices a self-inhibition posture, by interlocking his fingers with each other and spreading the hemiplegic thumb with the other thumb on the healthy side. The patient performs an upper limb extension.

For the inhibition of the lower limb the therapist inserts his thumb between the patient's big toe and the second toe and per-

forms an extension of the big toe, a dorsal flexion associated with an eversion of the foot and thus facilitates triple flexion, abduction and external rotation of the hip. The proximal key points are: head, neck, scapular belt, pelvic girdle, spine. The distal key points are realized by inserting a small cushion under the shoulder and under the pelvis on the hemiplegic side. The spasticity yielding like the blade of a penknife, it is not necessary to maintain the point.



Figure 1: Physiotherapy objectives of rehabilitation in the acute phase.

Muscle retractions are predominantly located on the muscles most affected by stroke (pectoralis major, elbow flexor, wrist and finger flexor and from the first commisure to the upper limb; and the lower limb: hip flexor, knees, triceps sural, plantar flexor), they are favored by the insufficiency of passive mobilization, and the "unconscious" setting in a short position in a challenge of paresis and not plegia

- Most affected Musculoskeletal circuits MS :
- 1- Shoulder Adductor
 - 2- Elbow Flexors
 - 3- Wrist Flexors
 - 4- Finger Flexors
 - 5- Thumb Flexors
 - X- Sometimes a facial injury
 - MI:
 - 1- Hip Flexor
 - 2- Knee Extender
 - 3- Knee Flexor
 - 4- Plantaral Flexor
 - 5- Hallux Extender
 - Xa- Static morpho-disorder of the axial hinge (spine) after verticalization or in chronic phase, RMS+MI+Xa

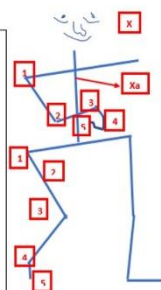


Figure 2: Functional and natural hemiparetic history, from flaccid paresis (acute) to spastic deforming paresis later, if nothing is done.

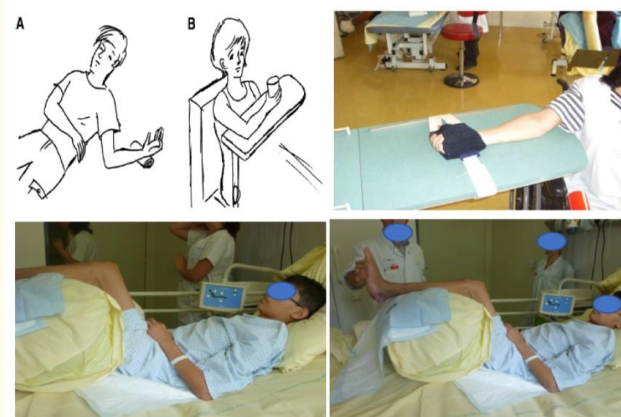


Figure 3: Posture to adopt in the first few days.

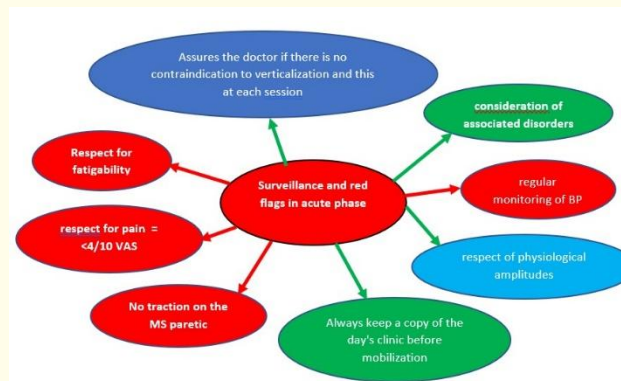


Figure 4: Physiotherapy monitoring before and during any intervention (acute phase) from D1 to D15

Conclusion

We now know that post-stroke complications are largely the result of central and peripheral decompensation left by the contestation of lesion-induced vulnerability. And that it is possible to prevent some of these disorders through ultra-early management alongside medical care, through extension postures, lengthening (against retraction). Because in the absence of this physical care, retractions and muscle disease re-deteriorate and increase the primary neurological deficiency (paresis) by efferent pathways

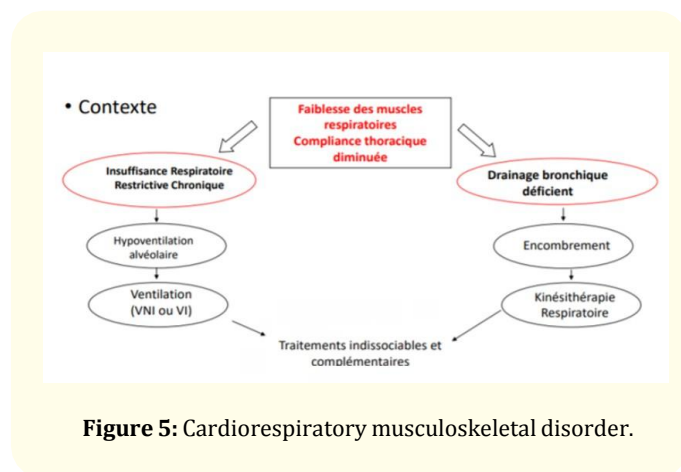


Figure 5: Cardiorespiratory musculoskeletal disorder.

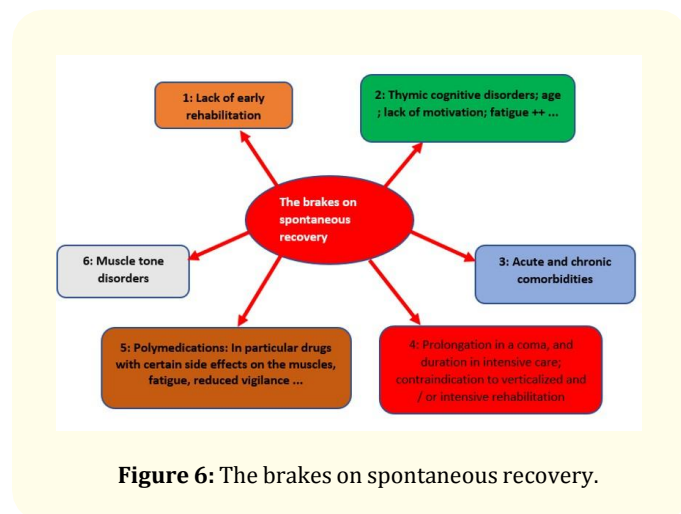


Figure 6: The brakes on spontaneous recovery.

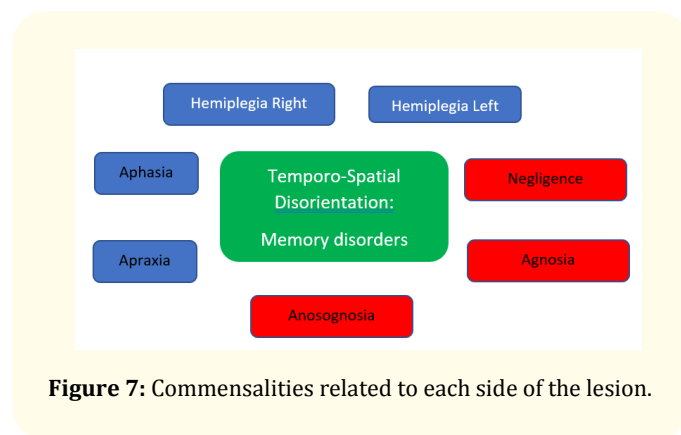


Figure 7: Commensalities related to each side of the lesion.

Objectives	Means/Techniques
From J1 if no contraindication : <ul style="list-style-type: none"> - Retractions. - Shortening and the birth of bad habits. - Therapeutic education - Early treatment = good psychological effect for the patient who feels accompanied - If visuospatial heminegligence, contribute to awareness by putting yourself on the neglected side for any communication or any activity. 	<ul style="list-style-type: none"> - Passive mobilization of decubitus, - Putting the joints in the long position of the extensor muscles of the shoulder, elbows, wrist and fingers) and of the flexor muscles (hips, knees and plantar flexors). - Educational advice - Sensory awakening exercises
From J7 if no contraindication: Improve motor control; beginning of the survey of diachisis (period of end or reduction of inflammation (interleukin-1 (IL-1)), intervention of pro-inflammatory cytokines). Beginning of reorganization and post-injury plasticity. In case of shoulder pain or complex regional pain syndrome type I = protect the limb and the painful joint by shortening (under a sling) momentary and not permanent to avoid retractions. NB: Very long stimulation period.	Introductory passive and active exercise with initiation to strengthening, analytical and global motor skills: <ul style="list-style-type: none"> - Gripping, - Balance - Market
From J21 : <ul style="list-style-type: none"> - ++ stimulation of plasticity and support reorganization: - Reduce the impact and sensory disturbances - Avoid the installation of spasticity. NB: at this stage the spasticity is very severe and musculotendinous retractions remain to be feared (initiation to the self-rehabilitation contract, because conventional physiotherapy sessions will no longer be sufficient)	<ul style="list-style-type: none"> - Gradually improve strength if the controls are analytical enough - Sensitive awakening and discrimination exercises - Exercise of joint control of the limbs and trunk - Control of balance and improvement of kinematic parameters by walking at repeated high speeds. - Segmental strengthening on quadriceps, hamstrings and plantar flexors - Segmental stretching on the adductor muscles of the shoulder, elbow, wrist and fingers - Increased time and difficulty of training
J 90 : The plasticity induced by the injury begins to diminish. It is necessary : <ul style="list-style-type: none"> - Improve autonomy regardless of the recovery (if it is insufficient) - Improve motor control, continue to stimulate brain plasticity - Restore the deficit order as best as possible 	<ul style="list-style-type: none"> - Already thinking about developing functional compensations - Possibility of possible recourse to equipment and technical aids - Intensive gait and balance training - Learn compensation techniques - grip by healthy upper limbs
	- Intense effort re-training +++
NB: These techniques should not be fixed, but flexible, depending on age; the motivation, the severity of the injury, and especially the impact and clinical condition on the day of training. To the question that comes up frequently, both by patients and their families: "when will rehabilitation end?" how long will it last? "We answer that rehabilitation is lifelong just as sport is important for the healthy subject, rehabilitation is doubly important for hemiparetic patients. Since neurogenesis and repair are imperfect, the phenomenon of compensation must be developed throughout life.	

Figure a: Summary of rehabilitation techniques, according to Ibrahim Moumeni, 2020 [4].

following a poorly adaptive plasticity and a disuse of the injured side. The quality and quantity of the content of the physiotherapy is therefore crucial at the very beginning of the disease, precisely during the first two weeks, in order to avoid the installation of the cascade of protein and muscle component degradations that can

be a real challenge for the patient after these two weeks spent at Absolut rest. These techniques proposed in this article must be correlated with the clinic of the day, but the principles of use, posture, manual attack and instructions, and fundamental prerequisites of practice remain the same. The proposed work should have minimal constraints, but should evolve in intensity, repetition and analytical task. The goal from the seventh day must be fatigue (from training; but fatigue should be at a little level for the first 7 days and should be further and further away from the number of days after stroke. The more the days go by, the more the intensity must increase), because fatigue remains the stimulator of the growth product of cerebral plasticity. A good evaluation beforehand will allow us to target the target muscles to work and the daily objectives. The working time during these two weeks can be from 45 min to 1 hour by days of active work which physiotherapist, and passive work must be done by the patient, Nurses (assisted by the family) after the departure of the physiotherapist in order to maintain the active functions and make the previous physiotherapy achievements last.

Medication through exercise: therapeutic postures, two objectives: preventing retraction and treating the first complications

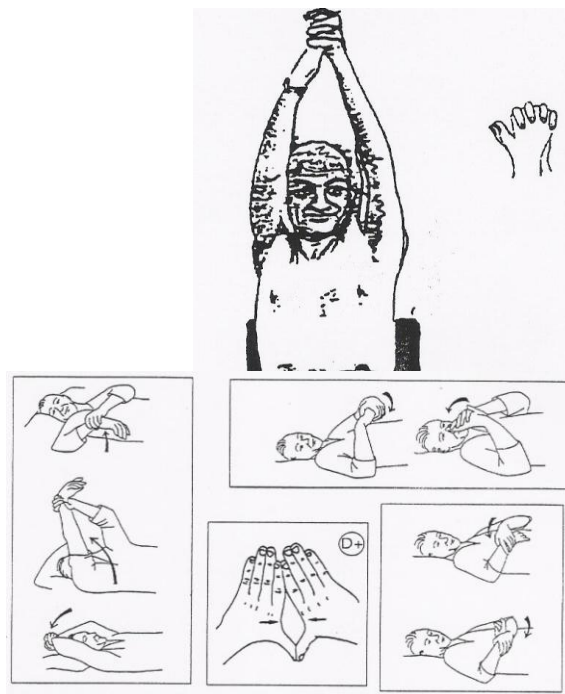


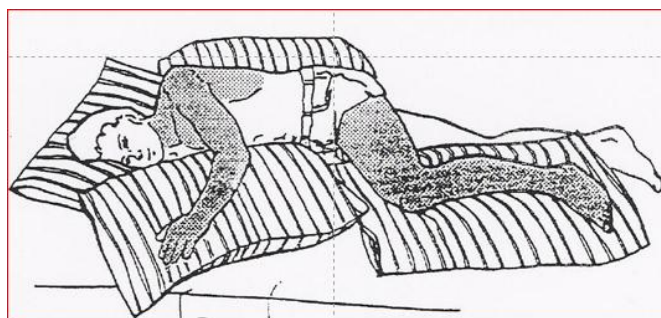
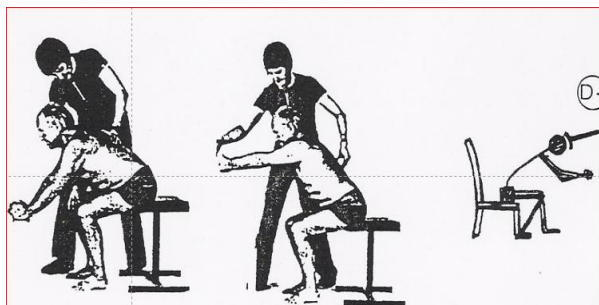
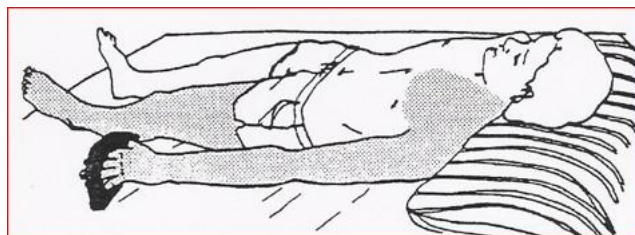
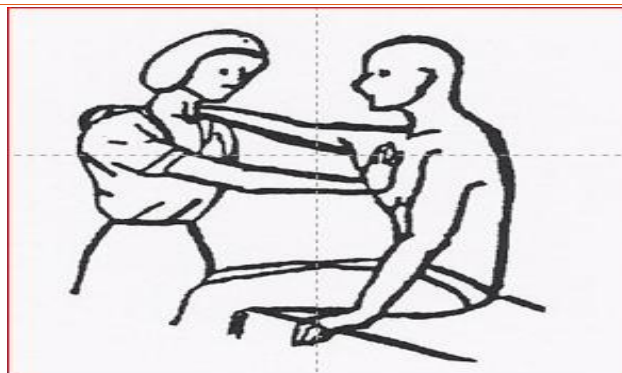
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