SCAN ME

MODELS AND ORGANIZATIONAL PATHWAYS IN THE TREATMENT OF ACUTE STROKE

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ABSTRACT

Stroke due to its sudden and nefarious course is today considered "a medical emergency" that requires proper prevention and adequate and time-depending treatment.
To follow the adequate guidelines (AHA-ASA 2018 and ESO-ISO 2018), stroke treatment involves the use of intravenous thrombolysis (IV) with Alteplase (or recombinant tissue plasminogen activator - r-tPA) within the first 4.5 hours of symptom onset and endovascular treatment within the first 6 hours if there were obstruction of large vessels such as the intracranial internal carotid artery, the middle cerebral artery (M1-M2), the anterior cerebral artery (A1) , the basilar artery and the tract intracranial vertebral artery.
After the described options of treatment the hospitalization in the "Stroke Units" is fundamental. This aspect, in the past largely undervalued, plays today a pivotal role in the patient's "care": continuous monitoring, combined with careful clinical observation, are, in fact, essential in order to both facilitate a faster possible rehabilitation of the patient , both to prevent any complications and / or exacerbation of the disease (or the possible closure of the vessel).
Aim of our lecture is to describe the result of years of controlled clinical trials, which have allowed us to reach a good level of knowledge on the efficacy and safety of the various therapeutic aids, only mentioned above, and whose use is regulated in detail by the main Guidelines (LG) in force today, including the Italian ISO-SPREAD LGs of 2016 [1] and the LGs produced by the American Heart Association (AHA), of which the American Stroke Association (ASA) represents a sector, and whose latest update is from 2018 [2].

INTRODUCTION

According to the World Health Organization (WHO) a Stroke is the sudden onset of signs and/or symptoms correlated with a focal and/or global (coma) deficit of the cerebral functions, that lasts more than 24 hours or fatal, that is not attributable to other causes than cerebral vasculopathy.
Therefore, ischemic stroke is a cerebro-vascular injury caused by the interruption of blood flow to the brain due to obstruction or rupture of an artery. When this happens, the blood flow is interrupted, and the neurons, deprived of the necessary oxygen and nutrients, even for a few minutes, begin to die, causing the patient severe disability and / or death.
According to the 2010 "Quaderni del Ministry of Health", "cerebrovascular disease represents one of the major social and health problems, as the second cause of death and the first cause of disability in the world. In Italy there are 200,000 new cases / year, of which about 80% are ischemic cases ... Only 25% of patients who survived an ischemic stroke recover completely. All the others have some deficits left, and in half of cases, the deficit is so severe that they lose self-sufficiency and often are forced to live in an institution for chronic patients. "
To make the problem even more worthy of attention, in fact, there are the implications and the risk of disability of cerebral stroke especially relating to functional, motor, language, psychological and cognitive difficulties. By their nature, the impacts of these deficits are complex and difficult to quantify.
Recent data from the 2016 ISO-SPREAD Guidelines estimate a serious disability in 35% of the "Stroke survivors" globally considered. The costs charged by both families and the national health system are therefore very high: according to the data announced by the Italian Stroke Observatory, it is estimated that a person affected by stroke costs Health Resources about 10,000 euros in the acute phase, around 100,000 euros in subsequent years due to permanent disability.
A recent work conducted by King's College London for the Stroke Alliance for Europe (SAFE), allows us to focus in particular on two important aspects represented by the worrying increase in the incidence rate of the disease (+ 34%) due to the progressive aging of the population and lifestyle, and the excessive variability of the mortality rate among the various European states (from 30 to 170 cases per 100,000 inhabitants). indicating the lack of adequate assistance throughout the territory.
It is therefore obvious that the adequate knowledge of both the treatment methods and the territory in which one operates is fundamental for the definition of the most appropriate therapeutic path: the Stroke Network is a time-dependent network in which the time variable assumes, as well as for all the other emergency/urgency networks, a primary role both in the general Stroke management plan and in each individual clinical case.

THE STROKE NETWORK: THE REGULATORY PATH

The Guidelines are the "tool" used in medicine to be able to practice Evidence-Based Medicine, as, by collecting the most current scientific evidence relating to diagnostic procedures and therapeutic measures, they offer a synthesis of them through operational recommendations that support the clinical practice. From this point of view, the Guidelines also impose

in different sites the "moral obligation" to update and they constitute the exhortation to abandon the obsolete methods of care, in favor of the "judicious, conscientious and explicit use of the best available evidence ".

The main organizational level is the legislative one, that allows the definition of organizational frameworks, minimum requirements and procedures, through national and regional norms and recommendations, and above all it defines the allocation of the necessary funds both for structural and/or instrumental adjustments , and for staff turnover.

In Italy, the first regulatory reference occurred during the State-Regions Conference (GU n.50 of 2 March 2005) on "Guidelines for the definition of the care pathway for patients with cerebral stroke", that creates the premises for a regional legislative work aimed at creating the Stroke Networks, able to provide uniform assistance throughout the territory.

However, the absence of a cost assessment and an implementation obligation have determined a quite varied panorama in the typology, in the method of drafting the resolutions and in the implementation of the same in the different Regions.

Later, the Papers of the Ministry of Health with the "Organization of stroke assistance: the Stroke Units" (2010) and with the "Criteria of structural, technological and clinical appropriateness in the prevention, diagnosis and treatment of cerebrovascular disease" (2012) highlighted the strong contrast existing between a pathology, such as stroke, which is the first cause of disability and the second of dementia with loss of self-sufficiency, and the "very little importance" that until then the various Governments succession had given to this problem.

The slowness and non-compliance of the Regions has been urged by the Decree of the Ministry of Health n.70 of 2015 (published in the Official Gazette no. 127 of June 4, 2015, and active since June the 19th). The decree is a complex health planning document which introduced, through the provisions contained in its technical attached, a series of important innovations for the Italian health system, to which the Regions and health facilities should have been adapted by 2016. Specifically , the attached is a regulation defining the qualitative, structural and technological standards relating to hospital care (including the standards relating to SU). The definition of dimensional standards, the analysis of the volumes of activity and the identification of the minimum outcome thresholds represent the essential tools for effective assessment of the quality of the services, while ensuring a substantial recovery of resources.

In relation to the creation of clinical-assistance networks, including that of stroke, the decree introduces and defines, in fact, a special body at regional level or "the Regional Coordination of the Network" which plays the important role of planning, promotion of actions, monitoring of the Diagnostic and Therapeutic Care Pathways (DTCP) and, last but not least, evaluation of the results.

In particular, as regards the stroke network, the decree affirms the need to:

- Ensure coherence between regional planning, network objectives and the objectives of the General Managers of the regional health authorities;
- Have a network plan consistent with the assigned objectives, personnel, technological and economic resources;
- Be based on specific shared DTCPs that allow integration between the activities of the hospital and territorial nodes of the network, as defined by level of complexity, including the emergency system 118;
- Have a data collection system for evaluating and monitoring the activities carried out, with indicators and reference standards for the Network.

The stroke network must also ensure that:

- Telemedicine and information data are shared between all points of the Regional Stroke Network and with the emergency system 118, bearing in mind that the involvement of the I and II level Stroke Units is in relation to the healthcare objectives of the individual case; in this sense, a solid IT infrastructure aimed at a fast and efficient teleconsultation, allows to communicate remotely with the various specialist figures;
- The following reference path is guaranteed: Alarm → Territorial Emergency care → stabilization / transport and assessment to centralization → Accident and Emergency Department (A&E) care / treatment /assessment for secondary transport;
- The network nodes are well identified with the procedures that must be carried out in each single node and in synergy with those of the other activated nodes;

If not present, the DTCPs in use in the zones / district are defined and a Basin / Vast Area DTCPs should be designed.

"The Clinical Care Network for Stroke (CCNS)", therefore, "is an organizational model that must ensure the care of patients, by relating, with formalized and coordinated methods, professionals, structures and services that provide interventions health and social health care of different types and levels in compliance with the continuity of care and clinical and organizational appropriateness. The Network identifies the nodes and the related connections, defining the operating rules, the monitoring system, the quality and safety requirements of the processes and care paths, qualification of professionals and the ways of involving subjects".

To ensure the best approach to stroke problems and achieve an overall patient care, the Ministerial Decree n.70 of 2015, identifies a care path that includes three phases, namely the pre-hospital phase, the hospital phase and the post-hospital phase, analyzed below, focusing on the various critical issues found in them.

THE ORGANIZATIONAL PATH

Pre-hospital phase

In stroke care, the concept of "therapeutic window", that is the time when it is still possible to intervene on the pathology without facing irreversible damage, is more relevant than ever. However, to date, only a minority of patients can access the so-called "bridging therapy", i.e. intravenous thrombolysis within 4.5 hours of acute stroke followed by mechanical thrombectomy within 6 hours of onset of symptoms.

The main causes of the extension of the so-called "door-to-needle" time are due above all to the activities

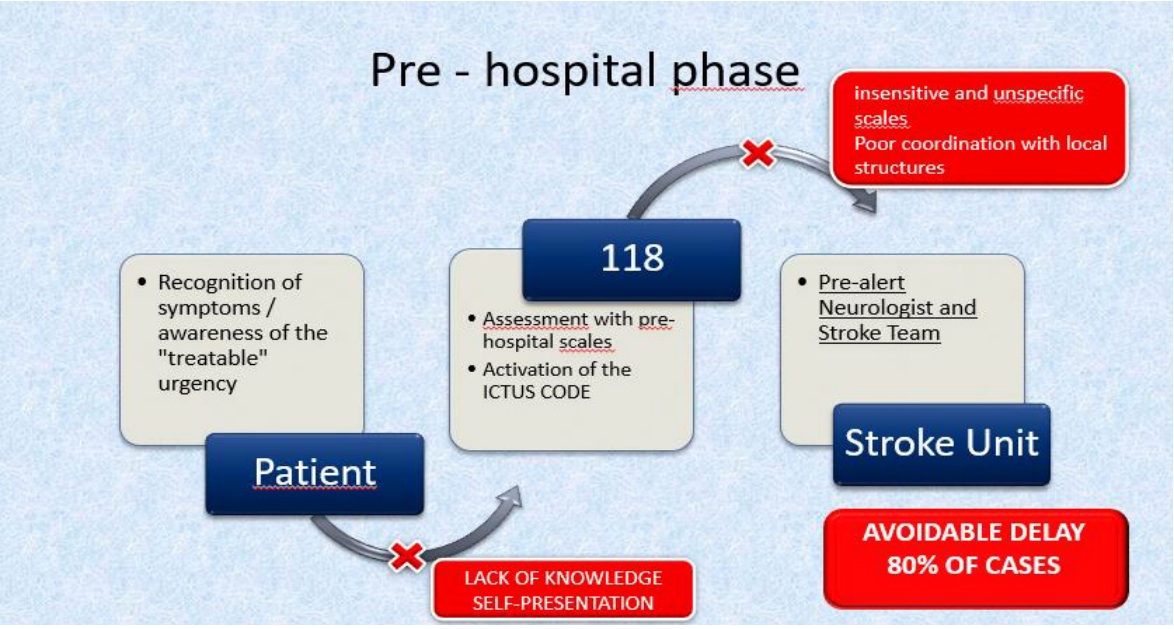

Fig. 1

carried before the patient reaches the hospital: some studies indicate, in fact, the pre-hospital delay as the responsible for over 80 % of diagnostic and therapeutic delay. In order to be able to offer the best possible care, it is therefore essential to carry out an analysis of the "organizational defects" that are the cause of an "avoidable delay".

The role of patients: stroke awareness

The main Guidelines, as well as the legislative references themselves, recommend the implementation of awareness programs, which in fact most European countries have undertaken through public campaigns, aimed at improving common knowledge on stroke symptoms and the most appropriate response to be adopted in urgent cases.

In this sense, the American model suggested by the American Stroke Association fully responds to this communication need: the campaign started in May 2009 places among the various initiatives the creation of a website that provides access to a series of links with educational support function including ACT FAST (aimed at increasing the ability to recognize the symptoms of stroke). FAST is, in fact, an acronym that stands for "Face, Arm, Speech, Time", aimed at a very fast clinical approach that identifies the presence of easily detectable neurological signs and allows to promptly alert the telephone number 911, and/or interact electronically to identify the most suitable therapeutic center.

In Italy, this concept accompanies all ministerial decrees including, lastly, the D.M. n.70 of 2015. However, to date, many national and European studies show that this knowledge is still very scarce, thus representing an important limit in the reduction of "door-to-needle" time, that is the access time to thrombolytic therapy . The patient, in fact, from 24% to 55% of cases, assumes inappropriate behavior when:

- He does not call 118 promptly, as he does not recognize that he has a problem that needs assistance, and this happens especially in the case of minor strokes;
- In the event that he uses a private vehicle to reach either the family doctor or the nearest hospital, which may not be equipped with a Stroke Unit and therefore cannot guarantee dedicated assistance.

In both cases, the patient, the main actor of this phase, is himself responsible for the inadequate care received. The reasons for such behavior are very profound and to be sought in demographic, social, economic, medical and psychological factors.

The role of 118: pre-hospital stroke assessment scales

"The 118 Operations Center has mainly technical-organizational functions, carries out the tasks of processing calls, identifying the intervention code based on the severity / urgency of the case, sending the most suitable means, driving to the place of the event". The call of 118, or more generally of the Emergency Services, is a crucial point in the management of the patient with stroke and is therefore widely regulated by the D.M. n.70 / 15 from which the above quotation is taken.

The structures of the Emergency Services differ from each other not only between the different Regions, but also within them. However, the Guidelines identified, and underlined in specific recommendations, some key elements that must be an integral part of each Emergency Service, namely:

- Adequate ongoing training of the Emergency team on the use of tools for recognizing stroke symptoms;
- Emergency transport of patients to a stroke-experienced hospital;
- The pre-notification of the receiving hospital.

The Emergency Services, unlike hospitals, do not have adequate equipment to be able to diagnose with certainty the cerebral stroke, nor the presence of large vessel obstructions, as the only "biomarker" for this diagnosis is the acquisition of a tomographic examination with contrast medium. In this regard, the D.M. n. 70/15, underlines the key role of 118 in describing the patient's signs and symptoms according to an "identified protocol" in order to allow the patient to be transported to the most appropriate structures.

A recent meta-analysis conducted by the American

HeartAssociation/American Stroke Association analyzed the different stroke assessment scales in order to identify the most accurate one. Starting from the NIHSS scale, considered as the optimal prediction tool for the occlusion of large vessels, but to be used in the emergency room due to its complexity, the analysis focused on three scales in particular, namely: the Cincinnati Pre-hospital Stroke Scale (CPSS), the Los Angeles Motor Scale (LAMS) and the Rapid Arterial oCclusion Evaluation (RACE). However, the evaluation made, paying attention to the choice of appropriate sensitivity values (increase in false positives) and specificity (increase in false negatives), did not lead to the identification of any scale in particular. The American and European guidelines, in fact, while inviting the definition of triage protocols and the choice of precise tools for patient assessment, do not indicate precisely an assessment scale as there is no scientific evidence that demonstrates the superiority of one over the other.

On the other hand, however, the ISO SPREAD 2016 guidelines with Strong recommendation in Favor and Grade B, identify in the Cincinnati Pre-hospital Stroke Scale as the tool that the personnel of the emergency vehicles must use in the management of the patient with stroke.

The stroke code

A separate paragraph should be devoted to the stroke code.

The introduction of a dedicated rescue code is required by all legislative acts, and is a tool that actively involves the operators of the Emergency Services as its effectiveness allows an increase in the number of patients eligible for thrombolytic treatment.

118 is the "mediator" of excellence, as the staff, properly trained, through the aid of evaluation scales, identifies a potential suspect of stroke and finally communicates with the hospital structures for the correct management of the therapeutic path (pre-notification).

The stroke code is similar to a red code in terms of "urgency", both for ischemic strokes eligible for thrombolysis and thrombectomy and for hemorrhagic strokes. It should be emphasized that in this case the urgency is related to transport or better still to the procedural timeliness that must characterize each phase of the process, both pre-hospital and hospital.

Several observational studies, as highlighted by the 2018 Prehospital Management Practical Guide, by the European Stroke Organization, reported that pre-hospital notification to the receiving hospitals, with or without priority transportation to designated stroke-experienced hospitals, led to significantly shorter door-to-needle times. The pre-notification, in fact, allows to effectively manage all resources, allowing priority access to instrumental examinations, such as CT for diagnostic confirmation and the fastest possible activation of the Stroke Team.

Furthermore, it should not be forgotten that in the observational studies considered, the correct pre-hospital management was associated with an equally adequate hospital reorganization, indicating that the pre-hospital "Stroke Code" and the hospital "code" are a continuum targeted to the reduction of the treatment time.

Hospital Phase

The hospital phase is the phase in which the patient receives care or treatment (thrombolysis and / or thrombectomy) for the resolution of acute ischemic stroke. However, for this to happen it is necessary to rapidly integrate data such as the patient's medical history, clinical examination, neurological evaluation, diagnostic studies and only then the therapeutic process can be defined.

The in-hospital delay accounts for 16% of the waste of time between the onset of stroke and the execution of brain tomography (CT). The reasons for this delay are due to the following aspects:

- Failure to recognize the stroke as an emergency;
- Inefficient in-hospital transport;
- Delay of medical evaluation;
- Delayed neuroimaging;
- Uncertainty in administering thrombolytic therapy.

Consequently, for a successful therapeutic treatment it is crucial to plan with scrupulous respect for the times spent in carrying out all the procedures necessary for the inclusion / exclusion of the patient in a specific type of treatment (hospital DTCP). Only an effective organization allows, therefore, to minimize the time interval between the patient's arrival and the start of treatment (door to needle time).

As for the pre-hospital phase, also in this case it is possible to identify some central actors:

- The nurse and the doctor at the triage;
- The Neurologist and the Diagnostic and Interventional Neuroradiologist (Stroke Team);

The triage nurse is the first person to receive the pre-notification from 118 or to welcome the patient who presents autonomously.

In the first hypothesis, since the 118 staff already made an assessment of the suspect of Stroke and collected all the necessary information (which also allowed him to go to the most suitable hospital), the nurse will only have to confirm the stroke code and report to the emergency room doctor and subsequently to the neurologist (also pre-alerted) what he learned from 118 about the patient's conditions, with particular attention to the time of onset of symptoms. In this case, the process is simplified, as the timely evaluation of the patient by the Neurologist, and the Neuroradiologist after the image acquisition, allows, in case of confirmation of the pathology, a quick choice of the most suitable therapeutic treatment and the subsequent hospitalization in the SU essential to be able to implement a correct diagnostic framework, provide and start adequate assistance.

In the case of self-presentation of the patient, the triage nurse must be the "first" to be able to recognize the "Stroke" and to collect all the useful elements to nominate the patient for specific treatments, or must:

- Collect, with the help of relatives, anamnestic data, with particular attention to the time of onset and the duration of symptoms or any onset upon awakening;
- Assess ABC (airway, breathing, circulation);
- Evaluate vital parameters (breath, arterial pulse, BP, O2 saturation);
- Apply the Glasgow Coma Scale (GCS);
- Apply the Cincinnati Prehospital Stroke Scale (CPSS).

This evaluation will be followed by first aid, patient monitoring and the execution of laboratory tests. Furthermore, in the event of a positive outcome, the nurse will have to activate the Stroke team.

As already pointed out several times, the treatments must be performed within certain times, always bearing

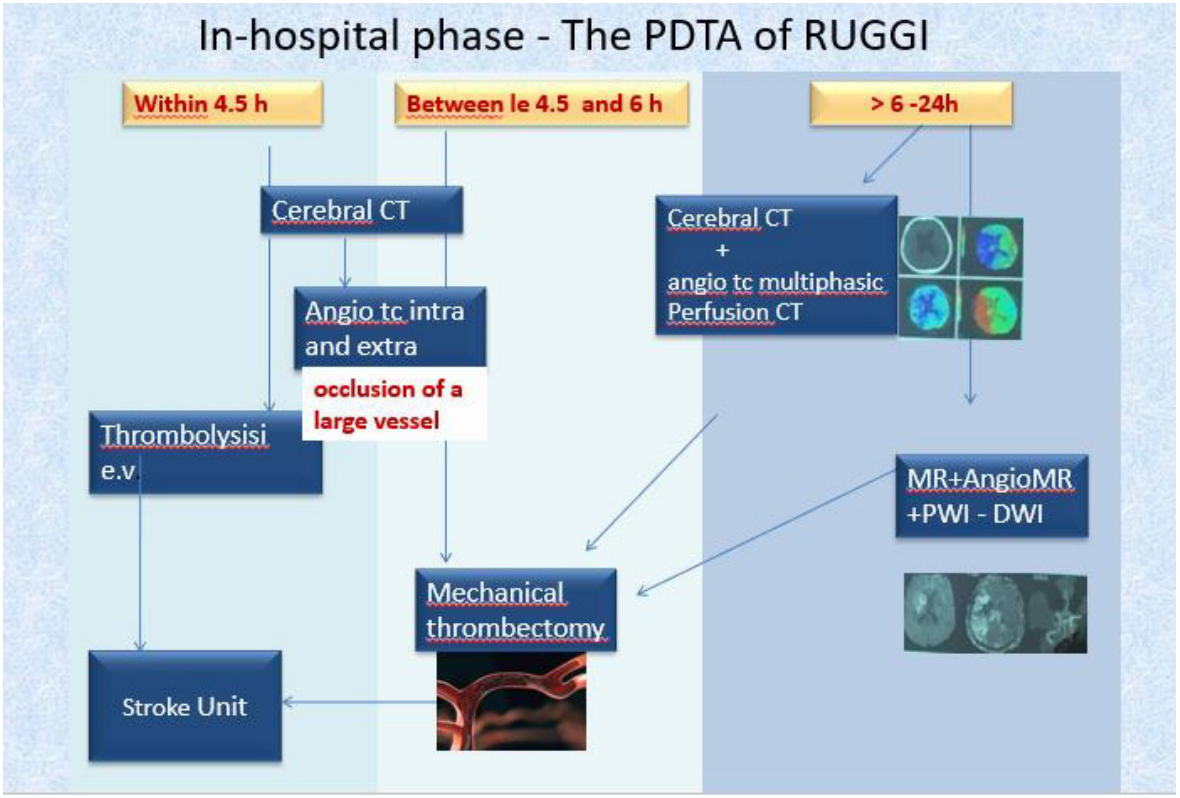

Fig. 2

in mind that the sooner the intervention is done, the greater the chances of complete recovery for the patient (i.e. the reduction or absence of disability).
This triage phase shouldn't last more than 10 minutes!
The neurologist, alerted by 118 or by the triage / emergency doctor to reach the emergency room, assesses the patient and confirms the diagnosis of stroke through:
The request for an urgent brain CT examination (whose results are evaluated with the Neuroradiologist);
In the event of SAH or intracerebral hemorrhage, the intervention of the neurosurgeon is required;
Apply the National Institutes of Health Stroke Scale (NIHSS) and the other quantitative scales provided and verify the inclusion-exclusion criteria for thrombolytic treatment;
Confirms the indication for thrombolysis and starts the relative path by obtaining informed consent to the therapy and the processing of sensitive data and directly providing hospitalization in SU on a monitored bed (in the absence of a monitored bed immediately available in the Stroke Unit, the neurologist can decide to administer the treatment when the patient is still in a monitored bed in the emergency room).
The evaluation of the Neurologist must not last more than 15 minutes !!!
The Neuroradiologist collaborates with the Neurologist both in the diagnostic-instrumental phase, performing and evaluating CT and Angio CT of the brain (maximum time 15 minutes) or proposing further assessments with Magnetic Resonance examinations (DWI, PWI and Angio) in the event of a temporal window beyond 6 hours, both in the evaluation of the interventional phase of thromboaspiration, of which he is the protagonist, in the case of obstruction of the great vessels,
The action of the different figures in the in-hospital path is very variable and complex. The above is certainly an example that allows us, however, to identify a general picture of the hospital path of a patient with a suspected stroke, excluding the enormous individual variability with which the disease occurs (including comorbid conditions). The main purpose, in fact, is to focus attention on the timing of the aforementioned path, which several studies outline as follows:

- Triage - taking charge 10 minutes,
- Execution and results of blood tests 30 minutes.

Simultaneously with the execution of blood tests:

- Clinical evaluation 15 minutes
- Neurological and NIHSS evaluation 15 minutes
- Brain CT execution and evaluation 15 minutes
- MRI execution and evaluation (DWI, PWI and Angio) 30 minutes
- Informed consent 5 minutes
- Total time "door to needle" overall 45-90 minutes.

The current GL ISO - SREAD 2016 state, in fact, that "it is desirable that in a hospital with a I level Neurovascular Unit (Stroke Unit), laboratory tests and radiological studies with CT and / or MRI are carried out within the maximum time 60 minutes from hospitalization ".

Post - acute / post - hospital phase

The large number of "Stroke survivors", most of whom with more or less disabling long-term disabilities, makes it necessary to combine proper management of the acute stroke with an effective rehabilitation program.
The rehabilitation process after stroke must have as its objective not only the management of stroke complications, but also the achievement of the best quality of life for surviving patients, with particular attention to the psychosocial problems that this pathology entails.
Stroke Units play a key role in this process since patients admitted to a stroke ward show not only better short-

to-very-short-term functional outcomes (7-14 days), but also greater survival and greater functional benefits at medium (28 days) and long (12 months) term. The management in the SU of the main complications of the subacute phase of stroke must therefore be the first step in the complex rehabilitation process. With this in mind, the Stroke Unit Trialists' Collaboration has identified the key points of effective post-stroke rehabilitation:

- The need for a multidisciplinary and coordinated team.
- The early start of rehabilitation, even if the recent guidelines advise against intense rehabilitation activity within 24 hours, promoting instead a moderate intensity rehabilitation consonant with the benefit and tolerance supported by the patient after the first 24 hours (LG ISO - SPREAD 2016).
- Early identification and treatment of impaired functions.
- Planning of the rehabilitation process after discharge.
- Constant involvement of family members or caregivers in the rehabilitation process and complete information about the Stroke, its consequences, the possibilities of recovery and the services available in the area.

Organizational models: "Drip and Ship" or "Mother Ship"?

The evaluation of the organizational path of the Stroke Network in the area is a very complex aspect and is still under evaluation through randomized clinical trials, such as RACECAT1, which aim to identify a strategy that involves the lowest possible risk for the patient and at the same time the best use of available economic resources. While waiting for more detailed answers provided by the study, the must is "to avoid excessive delays"; this is possible by using available resources such as telemedicine, quality processes with time metrics, information and training campaigns that reduce pre hospitalization.

In this regard, the D.M. n.70 of 2015 dedicates a large part in which, while delegating to the various regional realities the choice of the most suitable organizational model for the territory and the structures considered, it points out the need to adopt shared protocols and procedures, validated by the Network Coordination and that support the actors involved in the Stroke Network in the choices to be made regarding the transfer of patients.

To date, two main organizational models can be evaluated: "MotherShip" and "Drip and Ship".

In the "MotherShip" model, patients are transported directly to II Level ED (Comprehensive Stroke Center), as there are no Spoke centers, i.e. there is primary centralization. In this case the total time for access to therapy is given by the sum of the travel time to the II level E&A, the door-to-needle time for thrombolysis and the door-to-groin-puncture time for thrombectomy. By doing so, therefore, there is an optimization of the times for the application of mechanical thrombectomy. RACECAT: Randomized clinical study aimed at investigating the hypothesis that direct transfer to an endovascular stroke center, bypassing the nearest local centers, offers a better result in terms of reduced disability, in patients with acute ischemic stroke with suspected major occlusion vessels clinically identified by the Emergency Service.

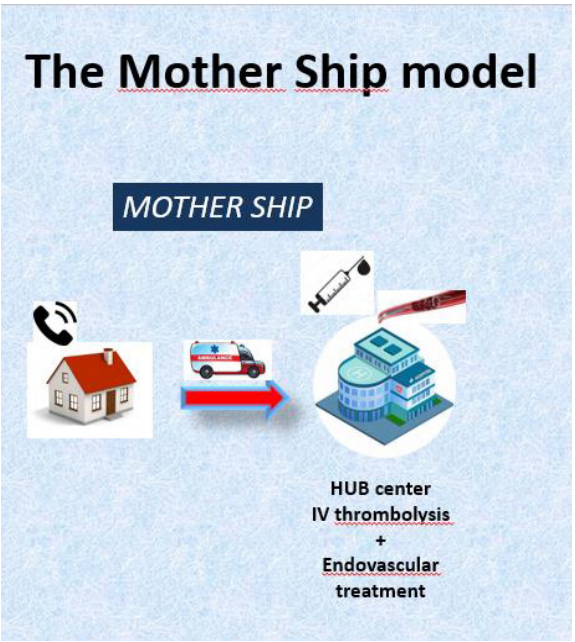

Fig. 3

The "Drip and Ship" model is inspired by the Hub and Spoke network set up precisely to be able to cope with another important and widespread vascular disease, namely heart attack. Similarly to the organizational model of the infarct network, therefore, the "Drip and Ship" model provides for two levels of management of the patient with acute stroke: the latter taken from 118 will be transported first to a Spoke center (1st level E&A) to receive i.v. thrombolysis and only subsequently in a HUB center (II level E&A) in the event that mechanical thrombectomy is deemed necessary (indicated in about 30% of cases). In this model, the total treatment time is equal to the sum of the travel time to the 1st level E&A, the door-to-needle time for thrombolysis, the travel time to reach the II level E&A (door-in-door -out) and door-to-groin-puncture time for thrombectomy: the result is, therefore, an optimization of thrombolysis times, to the detriment of thrombectomy.

At a first not very careful analysis, we might prefer the MotherShip model as it would mean offering the patient all the treatment options currently available for the treatment of stroke, regardless of whether or not they actually need them. However, this assessment contrasts with some crucial aspects. The II level E&A structures - HUB centers, in fact, appear to be the reference in the territory of 1,500,000 people as codified by Legislative Decree 70/15, so reaching them does not always mean doing first.

Another aspect is related to the assessment of acute neurological deficit, which is entrusted to pre-hospital triages with the aid of approximate assessment scales (insensitive and specific), so there may be cases of false positives. On the basis of these considerations, the "Drip and Ship" model fits well, as the "Pit-Stop" at the Spoke centers allows a greater number of patients to have access to e.v. thrombolysis, which presents an "unchangeable" time window!

However, even the "Drip and Ship" model has intrinsic limitations, often represented by the organizational deficit that delays secondary transport between Spoke and Hub, thus delaying the fundamental endovascular

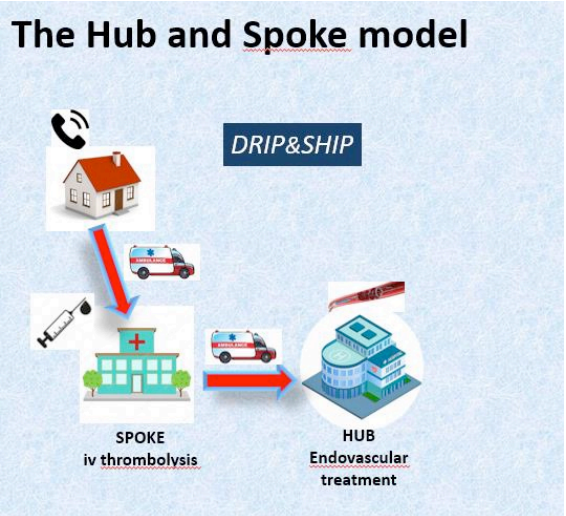

Fig. 4

treatment in patients with large occluded vessels.
Our analysis is obviously a clear modeling of reality which turns out, instead, to be much more complex and influenced by an infinity of variables not considered, such as the severity of the stroke, the comorbidities, the premorbid functional state, the response times of the 118, traffic, the not insignificant territorial variability in which one operates, etc.
The latest update on organizational models is provided by a recent meta-analysis, that evaluated the two models, through the analysis of eight selected studies (for a total of 2068 patients), and found better results, in terms of greater probability, of functional independence at 90 days, for patients treated according to the "MotherShip" model.
Finally, another approach is provided by the "Drip and Drive" model, in which the interventional neuroradiologist is mobilized. In this case the organization of patient transport would be avoided, which is often among the most time-consuming factors, since the services must be coordinated and require the availability of the helicopter service (sometimes necessary) depending on the weather conditions. However, this model also provides for the availability, in the facilities reached by the neuroradiologist, of an equipped angiography room and the presence of trained paramedics.
It therefore seems obvious that the choice of the organizational model of the network is not generalizable, as it is affected by many variables strictly dependent on the different realities considered.

CONCLUSIONS

Today, if on one hand scientific advances and their elaboration in detailed Guidelines, have allowed the "formulation of a cure" for such a debilitating pathology as stroke, their feasibility in daily practice is still very complex in many realities .
The LGs, in fact, are not enough to allow the applicability of the "theory" and the definition of a real course of care, but it is necessary a legislative support that through a careful analysis of the territory, allows the establishment of real NETWORKS to guarantee timely assistance for a time-dependent pathology such as a stroke.In Italy, although all the Regions deliberated on Stroke, there is a certain slowness in terms of implementation, such that the more virtuous Regions such as Piedmont and Lombardy, in which the Stroke Network is already a reality, are opposed by Regions such as Calabria and Campania itself in which bureaucratic formalism delays the actuation of the Stroke plans.
However, the ever increasing incidence rates due to the progressive aging of the population and the non-negligible economic impact of this pathology necessarily require greater attention, especially in relation to effective health planning and the allocation of resources.

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