

Review Article**Stroke units: what do they do and what should we do?**

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**Abstract**

Stroke is a common and serious disease, with over a half million new cases per year and 150,000 deaths annually in US. In recent years, the nihilism toward the care of stroke patients has been replaced by a remarkable understanding of the underlying stroke mechanism leading to significant improvement in its management. The aim of this article is to introduce stroke units and at the end, recommendations for stroke unit establishment in Isfahan, the second greatest city of Iran.

**KEYWORDS:** Isfahan, stroke unit, rehabilitation, comprehensive stroke unit.

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Stroke is a common and serious disease, the main cause of long-term disability, with over a half million new cases per year and 150,000 deaths annually only in US.<sup>1,2</sup> The World Health Organization estimated that, in 2005, stroke would have accounted for 5.7 million deaths worldwide, equivalent to 9.9% of all deaths.<sup>3</sup> Over 85% of these deaths would have occurred in low and middle-income countries.<sup>3</sup> Both common and regrettable, stroke has a vast impact on society. It is the leading cause of long-term disability in adults and third to heart diseases and cancer in causing death worldwide<sup>4</sup>; nevertheless, it is managed not only by specialized academic medical centers, but also the majority of stroke patients are still seen by local general hospitals.<sup>5</sup> Stroke has been increasingly recognized as an important and expensive medical and social problem during the past 10 years<sup>6</sup>; however, in recent years, the nihilism toward the care of stroke patients has been replaced by a remarkable understanding of the underlying stroke

mechanism leading to significant improvement in its management.<sup>7</sup> Stroke care now requires rapid assessment and triage in the acute phase to implement thrombolysis. Timing is critical; every 10-minute delay in treatment substantially reduces the chance of a good outcome.<sup>8</sup> In Iran, similar to other industrialized countries, stroke is a major cause of morbidity and mortality. Since growing of risk factors in Persian population such as hypertension, hyperlipidemia, smoking, and obesity as a result of immobility and modification of old healthy life style, chronic diseases such as stroke are increasing; thus healthcares should design programs and surveys to modify life style and aware people about hazardous impacts of civilian life style; other than our responsibility as a physician is suitable treatment of insults and rehabilitation of patients to improve life longevity and quality. In recent years, concept of stroke care unit/center is formed especially after introduction of thrombolytics, and attention to emergent treatment of stroke is

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increased.<sup>9</sup> Stroke care units similar to intensive care units or critical care units provide facilitations and personnel for better care of stroke patients. The aim of this article is to introduce stroke units and at the end, recommendations for stroke unit establishment in Isfahan, the second greatest city of Iran.

### **Are stroke units beneficial?**

In the last ten years, several clinical studies were conducted to find out factors that led to a better outcome after an ischemic insult on the brain. Stroke units and acute stroke teams were the most broadly evaluated factors.<sup>7</sup> Mostly studied in Europe, stroke units have lengthily been known to be victorious in reducing morbidity and mortality, increasing the proportion of patients returning home, dropping length of stay, improving quality of life for stroke survivors and perhaps reducing overall costs of stroke care.<sup>10</sup> They save lives, reduce dependency and handicap, improve functional outcome, increase the chance of returning home, reduces the length of stay in hospital and the need for institutional care<sup>11-15</sup>; furthermore, they decrease post-acute inpatient care costs and restore social abilities with less expenses.<sup>16,17</sup> These positive results from stroke unit care are shown during the acute stroke illness and appear to continue for at least 10 years.<sup>18,19</sup> To define the characteristics and determine the effectiveness of stroke unit care compared with conventional care in a general medical ward in reducing death, dependency, and the requirement for long-term institutional care after stroke, a systematic review was conducted in 1997.<sup>19</sup> The main outcome measures were regarded as death, institutionalization, and dependency. Stroke unit care was associated with a significant long-term reduction of death [odds ratio (OR): 0.83] and of the combined poor outcomes of death or dependency (OR: 0.69) and death or institutionalization (OR: 0.75). Beneficial effects were independent of patients' age, gender, or stroke severity and of variations in stroke unit organization. Length of stay in a hospital or institution was reduced by 8% compared with con-

ventional care. In a study performed in Ireland,<sup>20</sup> the stroke unit in comparison with general ward was associated with a shorter length of stay (mean 21 versus 33 days) and a higher rate of home discharge (50% versus 38%). Patient survival at discharge, 3 months and 6 months post-admission was better along with stroke unit patients.<sup>20</sup> In a study performed in Britain,<sup>21</sup> severe stroke patients treated on the stroke rehabilitation unit had a significantly better outcome compared with general wards. Mortality was reduced more than half (21% versus 46% in general wards) and median length of hospital stay was diminished also. In Chinese study, stroke unit care also significantly reduced mortality of patients with acute stroke after 28 and 120 days.<sup>22</sup> In another study in Chile, the mean length of stay in the stroke units was 6.6 days in comparison with 9.9 days of general wards.<sup>23</sup> In Turkish study, in-hospital mortality was significantly reduced in the stroke units. Length of hospital stay was shorter in stroke unit patients versus general wards (13.76 versus 16.72 days).<sup>24</sup> Evans et al<sup>25</sup> compared differences in management and complications of patients with acute stroke who were admitted to a stroke unit or to a general ward. Patients in the stroke unit were monitored 2.1 times, received oxygen 2 times and antipyretics 6.4 times, performed measures to reduce aspiration 6 times, and started early nutrition 14.4 times more than those in general wards. Complications were half in patients in the stroke unit than those in general wards.<sup>25</sup> In a recent meta-analysis in 2007, Seenan et al carried out a systematic review of observational studies that have measured the effects of stroke unit care in routine clinical settings. They identified 72 articles describing stroke unit outcomes; 25 were eligible for review; and 18 provided data on case fatality or poor outcome. Stroke unit care was associated with significantly reduced odds of death (OR: 0.79) and of death or poor outcome (OR: 0.87).<sup>26</sup> From 1995 to 1997, in a polish study, Ryglewicz et al Compared neurological status in 102 patients treated in a stroke unit with 140 patients treated in classical care model (general

ward).<sup>27</sup> The patients were matched by age. Neurological status and state of environmental dependency during the discharge time were similar in both groups, but the state of motor performance was significantly better in the group of patients treated in the stroke unit. They concluded that in the stroke unit, teamwork between nurses and rehabilitants makes it possible to augment the time of rehabilitation and to introduce the elements of exercises, which can be prepared by patients under control of nurse. Above data demonstrates that organized inpatient care or stroke unit care has been effective in randomized trials, wherein patients who were managed within a stroke unit were more likely to survive, return home, and regain independence; however, a recently performed survey demonstrated stroke units are a cost-effective stroke care need, and they should be considered as a sanitary priority<sup>28</sup>; despite the clear benefits to patient outcomes, stroke unit care has been slow to be adopted in countries.<sup>29</sup>

### **What exactly are stroke units?**

Broadly, stroke units provide multidisciplinary specialized care for patients who have had an acute stroke. In the best units, the team consists of nurses, pharmacists, social workers, medical staff, and occupational, physical and speech therapists. Although most stroke units are located in a special unit in a defined location, some hospitals use roving stroke specialist teams. The care provided by these teams results in better outcomes than care given on general medical wards, but stroke unit care is superior to it.<sup>30</sup> Stroke units can vary from acute interventional units (where patients stay less than a week), to rehabilitative units (where patients are admitted 1 to 2 weeks after symptom onset for rehabilitation), to integrated stroke units (where care is combined from the acute through the rehabilitation stages). All approaches appear to benefit stroke victims.

### **Who are admitted in stroke units?**

The main goal of stroke units is to admit patients suffering from cerebrovascular insults

such as ischemic stroke, intracranial hemorrhages including subarachnoid hemorrhage, and intracerebral hematomas. Type of stroke patients admitted in these units depends on predefined purposes of the medical system in which the stroke unit is established, the region's requirements, and the facilities present in area. The units should devise protocols for patients' admission to enter those who benefit from hospitalizing in these units and also preventing further conflicts. In case of a patient with lacunar infarct who is conscious, alert and oriented with well-condition, entrance to a primary stroke unit not only does not have any benefits for the patient but also may omit access of a patient with embolic stroke who may profit from thrombolytic therapy.

### **Stroke unit types**

Several stroke unit types and different organizations exist. For instance, in a survey performed in France,<sup>31</sup> five different types of stroke units were identified: those with intensive acute care and post-acute care, those with intensive acute care that were coordinated with a neurology department, those with beds in the neurology department, one with three levels (emergency, acute care and post-acute care) and one that shared intensive care with cardiology.<sup>31</sup> In year 2000, the Brain Attack Coalition (BAC) discussed the concept of stroke centers and proposed two types of centers: primary and comprehensive stroke centers (figure 1).<sup>32</sup> BAC is a multidisciplinary group of members from major professional organizations involved with the care of patients with stroke and cerebrovascular disease. Rehabilitation stroke unit is another type that only focuses on rehabilitation of patients.<sup>33</sup> It should be emphasized that an effective stroke unit must offer both acute medical treatment and rehabilitation and acute stroke is best treated in a joint stroke unit.<sup>34</sup>

### **Primary stroke care unit (PSC)**

Mark et al published details about specific elements of a PSC in year 2000.<sup>35</sup> A PSC has the required staffing, infrastructure, and programs

to stabilize and treat most acute stroke patients. A PSC would stabilize and provide emergency care for patients with acute stroke. Such centers would then either transfer the patient to a comprehensive stroke center or could admit the patient and provide further care depending on the patient's needs and the center's capabilities.<sup>35</sup> The BAC's recommendations for a PSC address the following 11 major aspects of acute stroke care<sup>35</sup>:

1. *Acute Stroke Teams*: The Acute Stroke Team ought to include a physician with experience in diagnosing and treating cerebrovascular disease, and one other health-care provider as a minimum. Hospital-based stroke teams should be available around-the-clock, seven days a week in order to assess within 15 minutes any patient who may have endured a stroke.
2. *Written Care Protocols*: Hospitals should have written procedures to streamline and accelerate the diagnosis and treatment of stroke patients. The availability of such protocols is a key step in reducing time to treatment as well as complications from treatment.
3. *Emergency Medical Services*: Emergency medical services (EMS) have a vital role in the rapid transportation and survival of stroke patients. Improved coordination between hospitals and EMS is a cornerstone of a PSC. One element of a well-integrated system would be effective communication between EMS personnel and the stroke center during rapid transport of a patient experiencing a stroke.
4. *Emergency Department*: The emergency department staff should have training in diagnosing and treating stroke and have good lines of communication with both EMS and the acute stroke teams.
5. *Stroke Unit*: A Primary Stroke Center wishing to provide care beyond the initial life-threatening period should have access to a Stroke Unit where patients can receive specialized monitoring and care. Some hospitals may choose to stabilize patients and transfer them to another facility.
6. *Neurosurgical Services*: PSCs should be able to provide neurosurgical services to stroke patients within two hours of when the services are deemed necessary.
7. *Support of Medical Organization*: The facility and its staff, including administration, should be committed to the PSC. This comprehensive commitment ensures the delivery of high quality and efficient care to acute stroke patients.
8. *Neuroimaging Services*: The ability to perform brain-imaging studies on acute stroke patients is vital for physicians to make a fast and accurate diagnosis of stroke patients. Brain-imaging studies include CT scans. A PSC must be capable of performing an imaging study within 25 minutes of the physician's order. The image should be evaluated by a physician within 20 minutes of completion.
9. *Laboratory Services*: Standard laboratory services should be available around-the-clock, seven days per week at a PSC. Standard laboratory services include rapidly performing and reporting blood counts, blood chemistries and coagulation studies. A PSC also should be able to rapidly obtain ECG and chest X-rays.
10. *Registry System*: PSCs should have a database or registry for tracking the number and type of stroke patients seen, their treatments, timeline for treatments and some measurements of patients' outcomes.
11. *Educational Programs*: The professional staff of a PSC should receive at least eight hours per year of continuing medical education credit. In addition to professional education, the PSC should plan and implement at least two annual programs to educate the public about stroke prevention, diagnosis and availability for emergency treatment.

### **Comprehensive stroke unit/center**

A comprehensive stroke center (CSC) is defined as a system with the necessary personnel, infrastructure, expertise, and programs to diagnose and treat stroke patients who need a



high intensity of medical and surgical care, specialized tests, or interventional therapies. The types of patients who might use and benefit from a CSC include patients with large ischemic strokes or hemorrhagic strokes, those with strokes from unusual etiologies or requiring specialized testing or therapies, or those requiring multispecialty management. Additional functions of a CSC would be to act as a resource center for other facilities in their region, such as PSCs.<sup>36</sup> A CSC would provide complete care to patients experiencing the most complex strokes that require specialized testing and other interventions. Such comprehensive stroke centers typically would include tertiary care medical centers and hospitals with the infrastructure and personnel necessary to perform highly technical procedures and provide all needed levels of care.<sup>35</sup> This might include providing expertise about managing particular cases, offering guidance for triage of patients, making diagnostic tests or treatments available to patients treated initially at a PSC, and being an educational resource for other hospitals and health care professionals in a city or region.<sup>36</sup> In 2005, Albert et al<sup>36</sup> developed recommendations for the establishment of comprehensive stroke centers. Recommendations were developed by members of BAC.<sup>36</sup> Herein, a summarization of their recommendations added by our comments is mentioned. Based on these recommendations, the key components of a CSC can be defined in 4 major areas<sup>36</sup>:

1. Personnel with specific areas of expertise.
2. Specialized diagnostic and treatment techniques.
3. Facility infrastructure.
4. Other programmatic areas.

#### *Personnel and Clinical Expertise*

A CSC should have the following personnel<sup>36</sup>:

1. A center director or leader.
2. Neurologists and neurosurgeons.
3. Surgeons with expertise performing carotid endarterectomy.
4. Radiologists with expertise in field of neuroradiology.

5. Physicians with proficiency in interventional endovascular neuroradiology procedures and techniques.
6. Expert emergency personnel.
7. Radiology technicians.
8. Nursing staff who are trained in the care of stroke patients.
9. Advanced practice nurses.
10. Physicians with expertise in critical care or neurointensive care, echocardiography, carotid ultrasound, and transcranial Doppler.
11. Expert physicians and therapists in field of rehabilitation.
12. Social workers.

Strong leadership is an essential element for the winning formation and operation of a CSC.<sup>36</sup> The CSC director ought to be a neurologist, although other medical professionals could fulfill this role.

#### *Diagnostic Imaging: Techniques and Personnel<sup>36</sup>*

##### *MRI*

Basic MRI at a CSC must be available, even if personnel are called in from home. The contrast resolution of MRI is significantly higher than computed tomography. An MRI should be completed within 2 hours of the test being ordered at a CSC.<sup>36</sup> Diffusion-weighted MRI (DWI) is very sensitive for detecting cerebral ischemia within minutes after its onset.<sup>37</sup> MR angiography (MRA) is a useful and noninvasive technique for visualizing abnormalities of the extracranial and the intracranial cerebral circulation. MRA is more sensitive than ultrasonography alone for diagnosing high-grade extracranial carotid stenosis.<sup>38</sup>

##### *Catheter Angiography*

Digital subtraction angiography (DSA) represents the gold standard for the detection and characterization of cerebral aneurysms, arteriovenous malformations (AVMs), and arteriovenous fistulae (AVFs), and for measuring the exact degree of stenosis in extracranial and intracranial arteries.<sup>39</sup> Because of the emergent nature of some of the stroke types discussed above, cerebral angiography must be available

at a CSC with support personnel available to come in from home for a procedure within 60 minutes of being called.<sup>36</sup>

#### *CT Angiography*

CT angiography (CTA) is a noninvasive method that is very helpful for rapidly imaging the large vessels in the neck and many first- and second-order arteries in the brain.<sup>40</sup> However, because of the significant flexibility and accuracy of CTA, particularly for patients who cannot undergo an MRA or a conventional cerebral angiogram, and its noninvasive nature, it is a recommended element for a CSC.

#### *Extracranial Ultrasonography (U/S)*

Carotid U/S is relatively low-cost and very safe method which neurologists can use it as a noninvasive screen for known disease in the extracranial carotid and vertebral arteries. It can be used in patients unable to receive contrast dyes or in whom an MRA is contraindicated (pacemaker, metal implants)<sup>36</sup>; therefore, neurologists should be familiar with proper exploit of this method. Based on a study conducted in Isfahan, Iran,<sup>41</sup> in Iranian stroke patients, the incidence of extracranial internal carotid artery stenosis is not uncommon, especially in over 70-years-old patients; thus, extracranial Doppler sonography is recommended for most patients with stroke for evaluating the vessels.

#### *Transcranial Doppler (TCD)*

TCD is a safe, noninvasive, and low-cost technique which neurologists utilize it for imaging the large intracranial vessels at the skull base. It is used in patients with acute cerebral ischemia for the detection of intracranial stenosis and occlusions and for the detection and monitoring of vasospasm in patients with neurological deterioration after subarachnoid hemorrhage (SAH).<sup>42</sup> Moreover, it also may have value for detection of intracranial stenocclusive disease, vasomotor reactivity testing, detection of cerebral circulatory arrest, monitoring carotid endarterectomy, and monitoring cerebral thrombolysis.<sup>43</sup> Contrast-enhanced TCD can also provide practical information in

intracranial occlusive disease, and hemorrhagic cerebrovascular disease.<sup>43</sup> Neurologists should be wholly familiar with these techniques and able to perform them independently. Based on its accuracy and importance in monitoring patients with SAH, TCD is a recommended element of a CSC.<sup>43</sup> According to a survey performed in Rafsanjan, Iran,<sup>44</sup> one-hundred patients with thrombotic stroke underwent transcranial sonography and color Doppler sonography of extracranial vessels. Forty-seven percent of the studied individuals had some variations in their color Doppler sonography of extracranial vessels, 27% had changes in the intracranial vessels and 26% showed changes in both. The most frequently involved vessels among the intracranial and extracranial vessels were the middle cerebral artery and the internal carotid artery, respectively.

#### *Transthoracic and Transesophageal Echocardiography*

Because a significant percentage of strokes are of cardioembolic origin, cardiac imaging is an important test in most stroke patients. Practice guidelines support cardiac imaging in cases of transient ischemic attack and stroke.<sup>45</sup>

#### *Diagnostic Radiology Personnel<sup>36</sup>*

A CSC must have physicians available to evaluate imaging studies. Although it is preferable that the attending physician be a fellowship-trained neuroradiologist, very few institutions have an in-house fellowship-trained neuroradiologist, although many have a general diagnostic radiologist available in-house. For urgent neuroimaging studies, physicians experienced in interpreting head CT and brain MRI studies must be available to read these scans within 20 minutes of their completion.

#### *Infrastructure and facilities<sup>36</sup>*

##### *Emergency medical service, emergency department, Referral, and Triage*

Written care protocols for acute stroke patients should be obtainable to emergency medical service (EMS) and emergency department (ED) staff. Such protocols should be reviewed and

revised at least once a year. EMS areas that should be included in such protocols include (1) rapid, efficient patient evaluation and triage; (2) prehospital EMS communication with hospital staff; and (3) medical stabilization en route.<sup>46</sup> The ED should have distinct and documented procedures for calling the acute stroke team, including a call program. The ED should have a door-to-needle time of 60 minutes for the administration of intravenous tissue plasminogen activator (tPA) to stroke patients.<sup>47</sup> The EMS and ED staff should meet and review patient care issues with the CSC staff at least twice per year.

#### *Stroke Unit and ICU*

A CSC must have a full ICU because some patients at a CSC such as those with large intracranial hemorrhages or subarachnoid hemorrhages will require the services of a typical ICU including intubation, ventilator support, peripheral artery and pulmonary artery catheters, ventriculostomies, and use of parenteral vasoactive medications.<sup>48,49</sup> The ICU in a CSC should be staffed by physicians with training in cerebrovascular disease and critical care, although they may be different persons. The critical care physicians must have completed an accredited critical care fellowship program. Formal training as a neurointensivist, although preferred, is not a requirement. Coverage by attending physicians or residents with expertise in cerebrovascular disease and critical care must be available with a written call schedule. Such coverage may consist of a team approach, with some members from critical care medicine or anesthesiology and others from neurosurgery or neurology. The nurse to patient ratio in an ICU caring for critically ill stroke patients should be 1:1 or 1:2. The ICU nursing staff must be trained to assess neurologic function and to deal with several aspects of neurocritical care, including (1) function of ventriculostomy and external ventricular drainage apparatus, (2) treatment of increased intracranial pressure, (3) care of patients with intracranial hemorrhage and subarachnoid hemorrhage, (4) care of patients after thrombolytic therapy, (5) treatment of blood pressure abnormalities with

parenteral vasoactive agents, (6) management of intubated/ventilated patients, and (7) detailed neurologic assessments and scales.

#### *Rehabilitation and Post-stroke Care*

A CSC should have physical, occupational, and speech therapists on staff or readily available by consultation for patient assessment and therapy during the acute hospitalization. Consults for physical medicine and rehabilitation, physical therapy, occupational therapy, and speech therapy should be requested and completed (when deemed medically necessary) usually within 24 hours of admission.

#### *Stroke registry system*

A stroke registry is an important element of a CSC. A stroke registry is a systematic collection of data that deals with stroke care, risk factors, outcomes, and related issues.<sup>50</sup>

#### *Education*

Educational programs are deemed a very important component of a CSC.

#### *Research*

Research programs are important components of academic medical centers, and some community hospitals are also becoming involved in clinical research trials.<sup>51</sup>

#### *Rehabilitation stroke unit*

After stabilizing patients in primary stroke unit, they are transferred to rehabilitation stroke units. Physical therapists, social workers and speech therapists are the core of these units.

#### **How many personnel are needed for a stroke unit?**

In 2002 Langhorne et al<sup>33</sup> conducted a survey of recent trials (published from 1985 to 2000) of a stroke unit/ward, which had demonstrated a beneficial effect consistent with the stroke unit systematic review. They identified 11 eligible stroke unit trials of which the majority described similar approaches and finally, provided a description of stroke unit care. They divided stroke units into two types: 1- com-

prehensive stroke units (CSU) (early management and rehabilitation), 2- rehabilitation stroke unit (RSU) (only rehabilitation). Bed numbers in comprehensive units was 6-12, and in rehabilitation units was 13-15. All units described a core multidisciplinary team of medical, nursing, physiotherapy, occupational therapy and speech and language therapy staffs. Staffs (number for 10 beds) included: seniors (0.5-1 for CSU and 0.2-0.3 for RSU), juniors (0.5-1.5 for CSU and 0.4 for RSU), trained nursing per daytime shift (2-3.5 for CSU and 2-2.5 for RSU), assistant nursing per daytime shift (0-1.5 for CSU and 1-1.5 for RSU), trained and assistant physiotherapist (1.2-1.7 for CSU and 1-2 for RSU), occupational therapist (0.6-1.7 for CSU and 1-1.3 for RSU), speech and language therapist (0.25-0.75 for CSU and 0.2-0.6 for RSU), and social work (0.6 for CSU and 0.4-0.6 for RSU).

### **What is performed in a stroke unit?**

Langhorne et al<sup>33</sup> explained process of care in stroke unit as:

1. Acute assessment and investigation.
2. Early management (days 0-3).
3. General patient management.
4. Discharge planning.
5. After discharge planning.

#### *Acute assessment and investigation*<sup>33</sup>

Initial assessment includes clinical history and examination, stroke scales such as NIHSS, Barthel, and level of consciousness scale such as four scale, routine biochemistry and hematology investigations, ECG and CT scanning in addition to the use of carotid Doppler ultrasound and echocardiography in selected patients. Indications for thrombolytic administration should be performed as soon as possible for potential candidates.

#### *Early management (days 0-3)*<sup>33</sup>

Early management include careful management of food and fluid intake, the use of insulin for hyperglycemia, the selective use of oxygen, cautious reduction of very elevated blood pressure, and lowering fever, compression

stockings to prevent deep vein thrombosis, antibiotics for suspected infection, prevention of urinary catheters, and treatment of constipation.

#### *General patient management*<sup>33</sup>

General patient management includes physiotherapy 45 minutes per patient per weekday, 40 minutes per patient per weekday occupational therapy, speech and language therapy.

#### *Discharge planning*<sup>33</sup>

Contact with patients and care providers should be performed to make appropriate comprehensive evaluations for hospital discharge.

#### *After discharge planning*<sup>33</sup>

Teams including physicians, nursing, social workers, physiotherapists, speech therapists, and psychologists can be supportive for follow up of patients. The patients should be visited regularly and home visits should be programmed for handicapped patients according to the facilities.

### **What problems might occur in our stroke units?**

The problems occurring in stroke units depend on social, cultural, technological, and economical factors. Some troubles might probably come to mind include lack of cooperation and coordination between medical personnel (between respondent physicians, between physicians and other staff and so on), unsuitable selection of patients for entering these units (selecting stroke patients who do not benefit from stroke units; stroke units would function as intensive care units and accordingly admitting non-stroke patients who need intensive care and as a result, mission of these units may change), pressure of patients' relatives to admit their patients in stroke care units without fulfilling criteria as the relatives would not accept the admission protocols and finally, inappropriate infrastructures and facilities might not cover all patients who benefit from stroke care units.



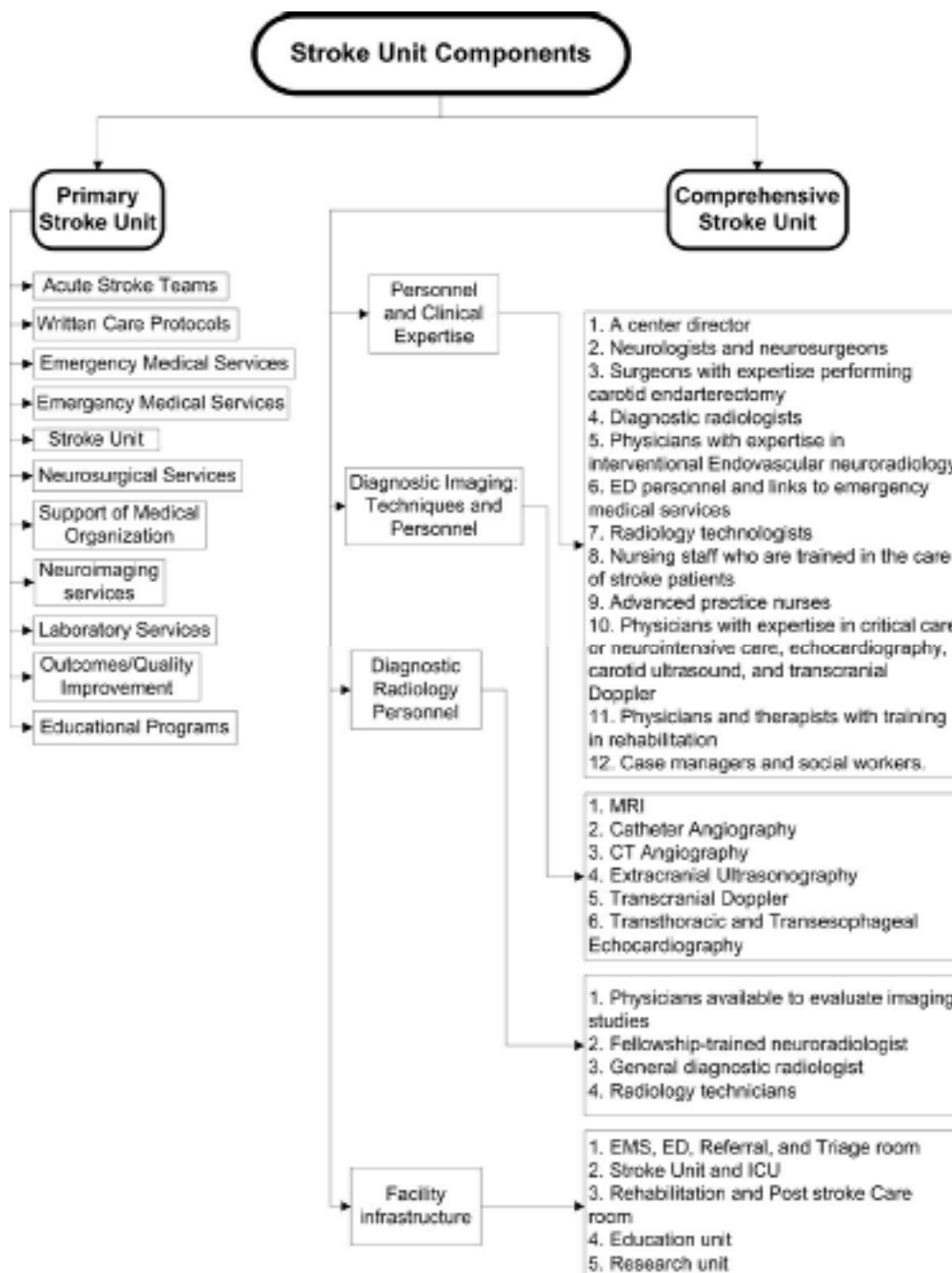
### What should we do now?

Civilization and its results such as reduced activity and exercise, smoking, pollution and obesity has caused highly increased rates of risk factors such as hypertension, hyperlipidemia, and diabetes mellitus. These risk factors have adverse effects on general health and ensuing increased prevalence of chronic diseases such as ischemic heart disease, and stroke. The prevalence of these chronic diseases such as stroke is rising in big cities of Iran like Isfahan. Today we are a young population with more than fifty percent of people under 30 years but we should consider that three decades later, regarding to decreased rate of births, everything will be reversed and we will have an old population. Therefore, we should get ready for huge epidemics of chronic disease that would occur in future; however, they are also epidemic now. The last survey about prevalence of stroke in Isfahan returns to year 2003.<sup>52</sup> Oveisgharan et al<sup>52</sup> performed a prospective study in four consecutive years on hospitalized stroke patients in Isfahan, from 2000 to 2003. A total of 4,361 stroke events (51.4% female and 48.6% male) were recorded in this period. About two thirds of them were older than 65 years, and more than 90% of them were from urban areas. The age-adjusted hospital admission rate in Isfahan increased from 2000 to 2003. The 28-day case fatality rates were about 32% in year. Ischemic stroke events made up the majority of cases (about 70%), and intracerebral hemorrhage events had the second highest prevalence (25%). They concluded that the stroke hospital admission rate might be increasing in Isfahan. In another study performed in North East of Iran (Khorasan),<sup>53</sup> the incidence of ischemic stroke was 43.17 cases per 100,000 people per year. During a 5-year period (from 2001 to 2005) 1,392 (53.02% female and 46.98% male) ischemic stroke patients were evaluated in their stroke registry. In another study performed in North of Iran (Babol),<sup>54</sup> the incidence of stroke was 50/100,000 population during 2 years. It happened more often in females than in males, and ischemic stroke (67%) was twice more fre-

quent than hemorrhagic stroke (33%). The mortality rate was 32% and the most common epidemiological risk factors for stroke in the region were hypertension, cardiac diseases and diabetes mellitus. Above data demonstrates frequent occurrence of stroke in Iran especially Isfahan. In recent years, interventional neurology has assisted many patients who were previously left in bad condition with no more than observation. Thrombolysis is an essentially cure for stroke patients and has had excellent results. In subarachnoid hemorrhage or arteriovenous malformations, interventional neurology has essentially changed the picture of disease and previously unobtainable locations now are yielded by angiography producing suitable treatments. But what should we do? If we do not, nobody will do it for us. Presently in Isfahan, similar to other parts of country, we are only fine observers of stroke patients who have come to us with great hope. Someday, stroke will also attack ourselves and somebody else should do something for us not just observe us. We should accept that epoch of sole medical treatment for stroke has terminated. Neurology Department of Isfahan University of Medical Sciences is one of the first pioneers of neurology science in Iran and a great deal of neurologists serving patients in any parts of country, are graduated from it; on the other hand, in recent years regarding rapid progression of this science in the world, our distance with other areas is increasing; therefore, we should speed up. Stroke care is unworkable without concerning a specialized stroke unit/center. To establish an efficient and effective stroke unit, we need three essential components: firstly, facilities, equipments, and buildings; secondly, specialists in the field, and thirdly, a good handle to coordinate the components. It is worthy to emphasize that stroke management needs a multidisciplinary team. Accordingly, cooperation among multiple departments is desirable that is not solely specialized to neurologists; a team consisting of a neurosurgeon, radiologist, anesthesiologist, cardiologist, internist, rehabilitant specialist, and other members such as trained nurses, so-

cial workers, occupational, physical and speech therapists. So, as to put into practice of the high-quality therapy in stroke care unit, neurologist ought to play the role of a team leader and director, running together with various members of the medical team.<sup>55</sup> Which form of stroke unit gives the best outcome is still an unsettled concern. The more intensive and timely multidisciplinary approach to the

acute stage of stroke, the better supervision of medical complications, and the earlier and more focused rehabilitation, are possibly the mainly qualifying features of our neurovascular treatment unit.<sup>56</sup> As a result, heads of university should prepare and train required subspecialists, firms and facilities to establish a competent stroke unit.



**Figure 1.** Stroke unit components.  
ED: emergency department, EMS: emergency medicine service.

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