Stroke networks and telemedicine: An Italian national survey

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Introduction

Stroke is the leading cause of disability and death. Nowadays, clinical benefits of stroke units and thrombolysis in ischemic stroke are evidence-based. Also the benefit of endovascular treatment for acute ischemic stroke has been established. Telemedicine has been used to improve access to care by allowing a neurologist at a remote location to interact with the patient and their family members. Prior studies have shown that the use of telemedicine for acute ischemic stroke is not only safe and effective, but it also increases the utilization of tPA, improving patient outcomes. This study aimed to investigate the diffusion of telemedicine in Italian stroke networks with an online questionnaire to assess: type of stroke care setting, Volume of thrombolysis-thrombectomy/year, access to stroke care between different hospitals, the presence of imaging sharing protocols within the network or patients dispatchment screening; type of network solutions. We have interviewed 24 Italian neurologists, working in large urban areas, from north southward, including Italian islands. In particular, these neurologists represented 14 different regions and 20 countries. A majority of neurologists replying to the survey (47.83%) worked in large general hospitals or smaller general hospitals (26%) and a smaller number of physicians (17.3%) were committed in University Hospital or (8.7%) independent foundation hospitals. The 60.87% of stroke networks involved in the survey had a low thrombolysis/year volume while the 30.43% had a thrombolysis/year volume above 100. According to the survey a local stroke network was established in 87.50% of cases. In the 45.83% of cases, the hospitals care is not homogeneous within the network. A network for the consultation of neuroimaging between hospitals is available in 33.33% of cases. Whith those describing an active network for Teleconsult the 57.14% used personal devices, while only the 25 % use professional teleconference system, and in 25% of cases used medical devices. Our findings demonstrated a relevant diffusion of Teleconsult in Italian stroke networks. The systems adopted are mostly individual solutions not integrated in protocolled pathways. These findings may encourage a systematization of Telemedicine medical curriculum to increase larger access to neurologial consultations.

Abstract

Stroke is the leading cause of disability and death. Nowadays, clinical benefits of stroke units and thrombolysis in ischemic stroke are evidence-based. Infact, stroke can be acutely treated with tissue plasminogen activator (tPA), significantly improving functional outcome when given to appropriately selected acute ischemic stroke (AIS) patients within 4.5 hours. Also the benefit of endovascular treatment (ET) after acute ischemic stroke has long been debated. Recent studies have demonstrated the clinical benefit of ET up to approximately 8 hours after stroke onset, mainly in association with intravenous thrombolysis. The positive effect is higher if ET is initiated early and performed by an experienced team. Current ET techniques include thrombectomy with clot removal using stent-retriever techniques or local thromboaspiration of the clot. ET seems to be so efficient that stroke care networks have to be organised to offer ET as quickly as possible in all patients who could benefit from this therapy. However, in Europe and in USA, national tPA treatment rates remain low despite the known benefits of treatment.2

Telemedicine (TM) is the use of telecommunication technologies to provide medical information and services.3 Telemedicine has been used to improve access to care by allowing a neurologist at a remote location to interact with physicians, patients and their family members. Prior research has shown that a way to increase access to acute neurological expertise is through TM diffusion. Telemedicine uses the direct audio-visual connections between a location that does not have expert specialist care and provides a remote physician, TM delivers quality health care from large distances.

The American Academy of Neurology, due to shortage of neurologists in north America, addressed curricula for certifying physicians in teleneurology.5 Prior studies have shown that the use of telemedicine for treatment of AIS is not only safe and effective, but it also increases the utilization of tPA, there by improving patient care and outcomes.6,7 Previous research has shown that acute stroke care provided through audio/video TM is safe with acceptable clinical outcomes and, in many instances, can significantly improve utilization of IV tPA.8-9 Since 2014, The American Stroke Association recommends that networks of telesstroke should be developed to provide acute neurological expertise to locations that lack of on-site resources to improve access to acute stroke care.10,11 In USA, fewer than 5% of patients who suffer from an AIS receive rt-PA.11 Even fewer patients
living in regions with limited stroke-systems of care are administered rt-PA, which may be due to long distances these patients must travel to stroke centers. Further, clinical expertise is essential to rapid diagnosis and treatment. Receiving care at a specialized stroke center, such as a Joint Commission (JC)-certified Primary Stroke Center (PSC), is associated with improved outcomes, as emergency physicians (EPs) often lack experience with rt-PA and are reluctant to use it. Only 1% of individuals in rural areas, however, live within a 60-minute ground ambulance ride of a PSC. Given the need for prompt evaluation and treatment, often including a neurological consult, there is concern that rt-PA is especially underused in rural or underserved urban areas. More generally, improving access to neurological services likely can improve the quality of care and outcomes for many patients with stroke, but it is unknown to what extent regional disparities in stroke care are related to disparities in access to neurological services. In Italy, in 2010, the health care authorities recommended guidelines about TM, to emphasize the use of this system and improve the accessibility of care in all the nation. However, inequities in coverage and in treatment provided still persist due to geographical barriers, trained personnel availability, technological capacity and organization among local health-care systems. However, in Italy the introduction of telemedicine into conventional health care seems still slow and inadequate.

This study aimed to investigate the diffusion of TM in Italian stroke networks. With an online questionnaire to assess: type

Table 2. Questionnaire answers overview.

| Question                                                                 | Answers                      | N. | %    |
|-------------------------------------------------------------------------|------------------------------|----|------|
| In your county is established a network of hospitals for the treatment of stroke? | No                           | 3  | 12.50|
| Access to therapies is homogeneous in all the different hospitals of your area? | No                           | 11 | 45.83|
| Is there a network for the consultation of neuro-imaging between hospitals? | No                           | 8  | 33.33|
| Do you have hospitals consultations or tele-phone contacts to agree on hub procedures or transfers of patients? | No                           | 0  | 0.00 |
| Do you use video or audio teleconferences to evaluate neuro-imaging data or clinical cases? | No                           | 12 | 57.14|
| If yes, what kind of technology do you use?                              | Certified medical devices    | 2  | 28.57|
| Others devices, including personal smartphones and/or social media       |                              |    |      |

Table 1. Volume (%) of thrombolysis and thrombectomy in participating hospitals.

| Year | N. | %    |
|------|----|------|
| Thrombolysis                           |                              |    |      |
| <10  | 2  | 8.70 |
| 10-20| 0  | 0.00 |
| >20  | 14 | 60.87|
| >100 | 7  | 30.43|
| Thrombectomy                           |                              |    |      |
| <10  | 10 | 43.48|
| >10  | 13 | 56.52|

Figure 1. A map of counties involved in the survey.
of stroke care setting, volume of thrombolysis-thrombectomy/year per site, access to stroke care between different hospitals, the presence of imaging sharing protocols within the network or patients dispatchment screening; type of network solutions.

Materials and Methods

Participants

With this retrospective study, we have interviewed 25 Italian board certified neurologists, that represented the larger urban areas (Milan, Naples, Rome), main stroke established centers from north southward of the peninsula, including also stroke specialists from the largest Italian islands (Elba, Sardinia and Sicily) (Figure 1). In particular, these neurologists comes from 14 different regions and 18 Italian municipalities. All of them had a specific interest in stroke or actively working in stroke units. The 47.83% of the sample neurologist worked in a general hospital, the 17.39% in the University Hospital, the 8.70% in research hospitals (IRCCS foundations) and the 26.09% work in regional hospitals.

During summer 2017, they have been subject to an online questionnaire to evaluate these items: type of structure working, number of thrombolysis-thrombectomy/year, type and quality of care between different hospitals, the presence of a network to evaluate neuroimaging or to organize transfers of patients to others Hospitals; type of technology of telemedicine solution to evaluate patients or clinical cases.

Statistical analysis

Descriptive analysis with absolute and percentage frequencies of the qualitative variables was performed by using the Statistical Package for the Social Sciences SPSS software, version 12 (SPSS Inc, Chicago, IL).

Results

The 60.87% of neurologists interviewed had a site with a volume of thrombolysis/year above 20, and the 30.43% above than 100 thrombolysis/year. While the 56.52% of neurologists that were interviewed reported a volume of thrombectomy/year above 10 cases (Table 1).

According to the expert opinion, there was an established network of hospitals for the treatment of stroke in 87.50% of cases. In the 47.83% of answers, the hospital care was not considered fully homogeneous inside the same network, and a network for the consultation of neuroimaging between hospitals was missing in 33.33% of cases. Inside the same network consultations (via telephone or any other mean) were possible in 62.50% of settings and a video or audio teleconference to evaluate clinical cases was done in 42.86% of such stroke networks. In particular, around 50% of physicians adopting any kind of teleconference, used their own mobile phones with non professional system and or social media (e.g.: Skype® , WhatsApp® and FaceTime®). While only the 25 % of doctors used professional teleconference system, (e.g: Cisco®) and in 25 % of cases used of medical devices (Table 2).

Discussion and Conclusions

Our findings demonstrated, at least a significant perceived gap, between hospitals standard care even in the same network.

The use of TM is large, but mostly with non professional devices or non medical equipment. These findings also suggest that adequate access to TM equipment may optimize the work of physicians and help access to stroke treatment as prescribed by evidence based statement. So there is a need to enlarge the diffusion of TM in all European countries to uniform stroke care.1,2

The use of personal mobile phones is generally forbidden by good medical practice worldwide and may be allowed just in exceptional events for emergency reasons, and generally outside the hospitals.2,3

Moreover personal devices may have troubleshooting problems with mobile phone coverage and can’t guarantee minimal quality standards. Equality to access of health care can’t be based on the mobile phone the doctor on duty has with him, or the band speed of a mobile phone company.

Standard of care in TM are urgently needed, as well as an integration with the national guidelines stroke care pathway. In order to guarantee higher standard of quality, data safety and privacy for the population.

The main limit of our study is the small sample of stroke experts involved, but the coverage of large urban areas, the balance between university hospital and general hospitals may offer an interesting overview on the topic.

All doctors interviewed, are broad certified stroke experts with more than a decade of experience in the field. A systematic survey on all stroke centers may be recommended but we must take into account how large areas of the country have a low density of stroke ready hospitals. We may speculate how the use of personal devices shall be larger in less developed areas of the nation.

The European Stroke Organization telestroke committee recently published an intents letter, in order to encourage national and international societies to facilitate the integration of telemedicine in standard stroke care. An expert opinion recommendation paper is on the way to be published.

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