An Introduction on Stroke

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I. Causes

Stroke is the leading cause of death and disability worldwide. Cell death because of poor blood flow to the brain causes strokes. There are two main types of stroke: ischaemic, due to lack of blood flow (this accounts for 87% of all cases[1]), and haemorrhagic, due to bleeding[2, 3]. Stroke can occur for all age groups.
Some risk factors (age, family history, ethnicity and medical history) can not be changed[3]. For infants and children, iron deficiency can cause ischaemic stroke[4]. For adults, the main causes of ischaemic stroke are smoking, hypertension, obesity, high cholesterol levels, diabetes, excessive alcohol intake, and the main causes of haemorrhagic stroke are being overweight, a lack of exercise, smoking, drinking excessive amounts of alcohol, stress[5]. Mortality and incidence of stroke both have a positive correlation with people aged $\geq$ 65 years[6].

II. Symptoms

As different part of a brain controls different part of a body, the signs and symptoms of a stroke are different on different person, but usually begin suddenly and could effect all parts of the body.
The main stroke symptoms can be remembered with the word "FAST"[3, 5, 7]:

- Face - the face has dropped on one side, the mouth or eye may have drooped.
- Arms - the person is not be able to lift one or both arms and keep them there because of weakness or numbness.
- Speech - the person be slurred, garbled or even not be able to speak.
- Time - it is time to call an ambulance if a person shows any of the signs or symptoms above.

A stroke can cause other symptoms as well, such as problems with memory, balance, or a sudden headache.
The symptoms of a transient ischaemic attack (TIA), also known as a mini-stroke, are the same as a stroke, but the symptoms will disappear thoroughly in a few minutes to a few hours. Although the symptoms seem minor, a TIA is a sign of problem with the blood supply to the brain. It means the risk of having a stroke increased soon.

III. Prevention and Treatment

i. Prevention

The problem of "three highs" (high blood sugar, high blood pressure, high cholesterol levels) increases the risk of stroke. To avoid stroke, people should keep a healthy lifestyle. And I conclude the key points for keeping a healthy lifestyle as TENET[8, 9, 10, 11]:

- Time - manage the time to get up and go to bed, irregular sleep can lead to endocrine disorders and make people stressful which could increase the risk of stroke.
- Eat - eat a low-fat, high-fibre, diet can reduce the chance of high blood pressure and high cholesterol levels.
- Nutrition - ingest adequate nutrition and stop smoking could reduce the risk of stroke.

- Evaluate - evaluate body mass index (BMI) regularly and keep it within a healthy range because BMI is directly associated with the risk of stroke
- Training - regular training help people lower cholesterol levels and keep blood pressure healthy

ii. Treatment

Two major kinds of treatment are used to cure stroke - with surgery and without surgery[12]. Normally, a combination of medicines can treat ischaemic strokes and prevent it from happening again. Different medicines like alteplase, aspirin, anticoagulants and statins are used depending on the conditions. Some ischaemic strokes are caused by narrowing of an artery in the neck, known as carotid stenosis. If the carotid stenosis is very severe, a surgery called carotid endarterectomy is needed to open up the carotid artery[12, 13, 14, 15, 16].
For haemorrhagic strokes, surgery is needed to repair any damaged blood vessels. A small tube called catheter is guided to the source of bleeding, then a mechanical agent called coil will be put in the vessel to protect it[12, 17].
For both types of strokes, the time from onset to treatment is a vital factor that influences the result of treatment. Treatment should be done within 6 hours after onset of a stroke and can benefit patients under certain conditions if the procedure could be done within 24 hours of onset[16, 18, 19].

IV. Technologies

i. Brain Imaging and Diagnose

Brain imaging is essential for stroke assessment, computed tomography (CT) and magnetic resonance imaging (MRI) protocols provide excellent tools for the evaluation of Arterial ischemic stroke (AIS) whose role is helping to select the best treatment. For this, CT and MRI are widely used in Brain Imaging[20].
Earlier in 2020, a non-invasive, and easy to use device called cerebrotech stroke detecting visor was announced that can detect large-vessel occlusion in suspect stroke patient with a sensitivity of 93% and a specificity of 92%[21].

Figure 1: *cerebrotech stroke detecting visor[21]*

Diagnose and prognosis prediction of stroke could be done by AI automatically in the near future. The risk of acute thrombolysis or intervention would be precisely predicted. Possibly, AI could foresee degree of post-stroke recovery in advance, which can enhance the treatment rapport and rehabilitation process[22].

ii. Rehabilitation

The effect of stroke contains different aspects including communication, mobility, memory, etc[23].
Researchers work on motor rehabilitation have done some great achievements on assistance and rehabilitation on stroke survivors, such as exoskeletons.

A. Yurkewich et al. designed an upper limb exoskeleton called HERO glove (Figure 2(a)) that help stroke survivors with severe hand impairment to grasp and stabilize objects[24].
C. J. Nycz et al. presented a light-weight push-pull Bowden cable wearable hand exoskeleton (Figure 2(b)) for stroke rehabilitation[25].
Z. Li et al. developed a lower limb exoskeleton (Figure 2(c)) that combines a brain-computer interface (BCI) based on motor imagery (MI) with surface electromyogram (EMG) signals[26].

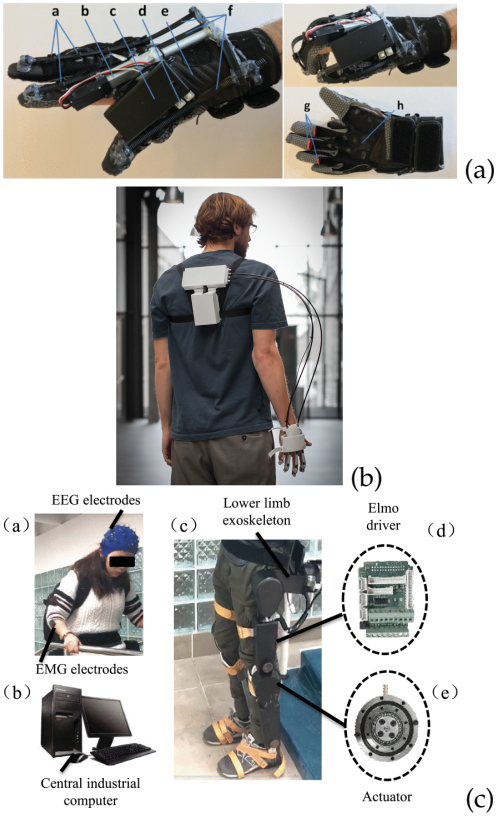

Figure 2: *exoskeletons for stroke rehabilitation[24, 25, 26]*

V. Conclusion

With development on AI, robotics and other areas, prediction, diagnose and recovery of stroke are getting faster, more accurate and reliable.

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