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Dear Doctor,

Greetings from Micro Labs. We are happy to bring you "Stroke Newsletter" which contains latest and interesting news in the field of Neuropsychiatry.

This issue contains:

1. Patients with Type 2 Diabetes Mellitus and Factors Influencing Post-Stroke Cognitive Impairment
2. A Cross-Sectional Pilot Study: Effectiveness of a Soft Robotic Glove to Assist Hand Function in Stroke Patients
3. Effectiveness of Stroke Rehabilitation Treatment Using Cross-Modal Deep Learning: Evaluation Algorithm
4. When Should You Look for a Genetic Cause of Stroke: Moyamoya Disease?

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Patients with Type 2 Diabetes Mellitus and Factors Influencing Post-Stroke Cognitive Impairment

Introduction: Type 2 diabetes mellitus is manifested as hyperglycaemia, obesity and insulin resistance which can lead to cognitive impairment along with ischemic stroke. Brain damage and mental illness in patients with T2DM has increased its prevalence.[1] Post-Stroke Cognitive Impairment associated in T2DM patients causes cognitive impairment, depression and stroke which are the complications of diabetic microangiopathy.[1,2] For early diagnosis, cognitive rehabilitation, to improve cognition through proper management, to delay disease progression, and to reduce early mortality it is important to identify effective indicators to predict the occurrence of PSCI.[2] The study aims to investigate the influencing factors of post-stroke cognitive impairment (PSCI) in patients with Type 2 Diabetes Mellitus (T2DM).

Methods: A total of 161 T2DM patients experienced with acute ischemic stroke were included in the study. Prediction model was established from general demographic data, laboratory information, imaging data, the results of neuropsychological evaluation, and clinical features as well as influencing factors of PSCI in these patients. Montreal Cognitive Assessment (MoCA) scale was used to evaluate patient's cognitive function. Patients were divided into three groups based on the cognitive function as; normal cognitive (CN) function with a score of ≥26 points, <26 points patients were considered to have mild cognitive impairment (MCI) and those with a score of <20 points were considered to have severe cognitive impairment (CI).

Results: A total of 94 patients were identified with CI, in which 61 were characterised as MCI and 33 of them was with severe CI. The levels of HbA1c and serum albumin in MCI and severe CI groups were higher than CN group (P<0.05) shown in table 1. The independent risk factors were RCI, course of DM, and glycated haemoglobin

	CN	MCI	Severe CI	P value
N	67	61	33	
HbA1c	6.00 (5.50, 6.75)	7.30 (6.60, 8.20)	8.40 (7.30, 10.50)	<0.001
Triglyceride	1.47 (1.09, 1.88)	1.35 (1.01, 1.92)	1.45 (1.05, 1.78)	0.797
TC	4.06 (1.11)	4.24 (1.16)	4.19 (1.29)	0.678
LDL	2.66 (2.06, 3.09)	2.45 (1.97, 3.06)	2.52 (1.62, 2.88)	0.811
Albumin	39.20 (38.15, 39.85)	36.4 (35.45, 37.50)	35.30 (33.11, 36.50)	<0.001
Fibrinogen	3.29 (2.86, 3.78)	3.23 (2.76, 3.86)	3.47 (3.05, 3.95)	0.685
Uric Acid	299 (235, 343)	301 (263, 403)	278 (235, 365)	0.196

Note: $P<0.05$, statistical significance.
Abbreviations: HbA1c, glycated hemoglobin; TC, total cholesterol; LDL, low density lipoprotein.

Table 1. showing biochemical criterion among cognition groups

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(HbA1c) with odds ratio of 7.17 (2.09, 30.37), 5.39 (2.40, 14.59), and 3.89 (1.66, 10.04) respectively, protective factors were female, senior high school, serum albumin 0.28 (0.07, 0.95), 0.05 (0.01, 0.21), 0.20 (0.08, 0.42) respectively in PSCI patients with T2DM. The area under receiver operating characteristic (ROC) curve was 0.966 (Figure 1). Prediction model suggested that there was a significant association of these factors in PSCI patients with T2DM.

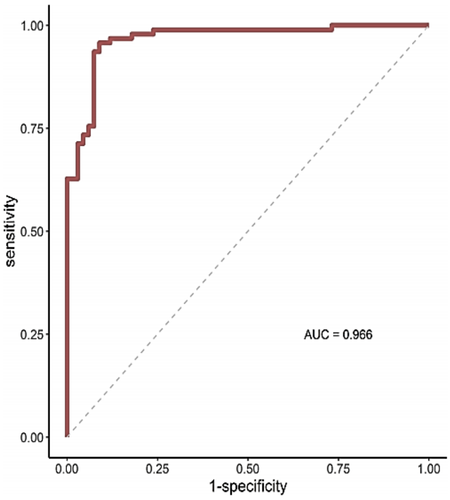

Figure 1. Receiver operating characteristic (ROC) curve using predictive model.

The study found that the risk of PCSI was higher in older age, low education level, long course of DM, and with multiple cerebral fractures.[2] Polidori et al stated that from longer exposure to glycolipid metabolic disorders, and severe oxidative stress patients with a long course of DM have severe microangiopathy that play a critical role in the development of atherosclerosis and cognitive impairment in patients with T2DM.[3] In another study by Albai et al stated the cognitive function that accelerates brain damage and aging was negatively correlated by increased HbA1c from hyperglycaemia.[4]

Conclusion: The study concluded that recurrent cerebral infraction, course of DM, and HbA1c were the factors influencing for the occurrence of PSCI in patients with T2DM. To identify high-risk patients with CI, provide a basis for early management strategies for patients with PSCI, help delay disease progression, and improve the quality of life of post-stroke patients the predictive model results of this study may serve as a potential tool.

For early diagnosis and timely intervention of cognitive impairment attention towards the influencing factors is essential in patients with T2DM

References:

1. Van Sloten TT, Sedaghat S, Carnethon MR, Launer LJ, Stehouwer CDA. Cerebral microvascular complications of type 2 diabetes: stroke, cognitive dysfunction, and depression. Lancet Diabetes Endocrinol. 2020 Apr;8(4):325-336.
2. Ma ZY, Wu YY, Cui HY, Yao GY, Bian H. Factors Influencing Post-Stroke Cognitive Impairment in Patients with Type 2 Diabetes Mellitus. Clin Interv Aging. 2022 Apr 29;17:653-664
3. Polidori MC, Mecocci P, Stahl W, Parente B, Cecchetti R, Cherubini A, Cao P, Sies H, Senin U. Plasma levels of lipophilic antioxidants in very old patients with type 2 diabetes. Diabetes Metab Res Rev. 2000 Jan-Feb;16(1):15-9.
4. Albai O, Frandes M, Timar R, Roman D, Timar B. Risk factors for developing dementia in type 2 diabetes mellitus patients with mild cognitive impairment. Neuropsychiatr Dis Treat. 2019 Jan 3;15:167-175.

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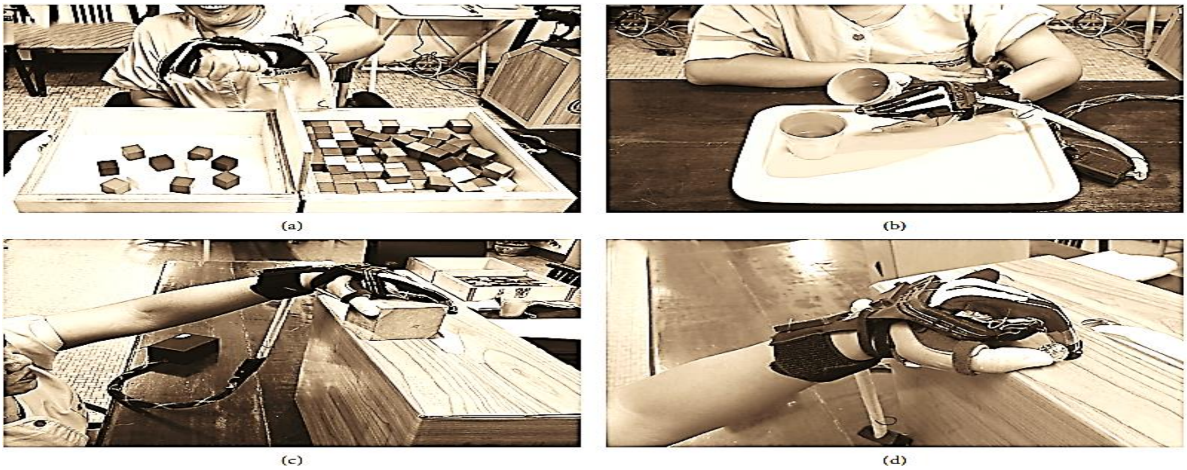
A Cross-Sectional Pilot Study: Effectiveness of a Soft Robotic Glove to Assist Hand Function in Stroke Patients

Introduction: Stroke is the fourth leading cause of death and disability worldwide.[1]The disability from stroke affects hand function and activities of daily living in many stroke survivors resulting in dependence. Stroke is even associated with memory loss, dementia, gait impairment, and other functional disability.[1,2] Hand rehabilitation, lightweight, low-cost exoskeletons, and soft robotic gloves are developed in recent years for assisting hand function in stroke survivors.[2] The study aimed to investigate the effectiveness of a soft robotic glove in assisting hand function in stroke patients.

Methods: A total of 20 stroke patients with partial or complete hand weakness were recruited from a rehabilitation centre in this cross-sectional pilot study. Two experiments groups were



(a) Box and Block Test
Action Research Arm Test: (b) grasp, (c) grip, and (d) pinch

made in which one using an affected hand with the soft robotic glove and without the use of the soft robotic glove. The BBT and the Action Research Arm Test (ARAT) were performed by using the affected hand with and without the soft robotic glove in crossover experiments. Computer-generated program was used for randomly assigning sequence of the experiments.

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Results: From the usage of glove BBT scores was increased to 6.4 blocks when using the soft robotic glove (p < 0:001). ARAT grasp, grip, pinch, and overall scores was increased by 27.08% (p < 0:01), 28.75% (p < 0:001), 15.89% (p < 0:01), and 21.15% (p < 0:001), respectively, when compared to not using the glove hand (Table 1).

	Using soft robotic glove ($n = 20$)	Without soft robotic glove ($n = 20$)	*p* value	95% CI
BBT, mean ± SEM	8.6 ± 2.0	2.2 ± 0.6	< 0.001	3.2, 9.6
ARAT, mean ± SEM				
Total	25.20 ± 4.43	20.8 ± 4.87	< 0.001	2.7, 6.1
Grasp	9.15 ± 1.5	7.20 ± 1.7	< 0.01	0.9, 3.0
Grip	5.15 ± 1.0	4.0 ± 1.1	< 0.001	0.6, 1.7
Pinch	6.20 ± 1.5	5.35 ± 1.7	< 0.01	0.4, 1.3
Gross movement	4.70 ± 0.8	4.55 ± 0.8	0.186	-0.1, 0.4

BBT: Box and Block Test; ARAT: Action Research Arm Test; SEM: standard error of mean; CI: confidence interval.

Table 1. showing scores of BBT and ARAT

In subacute and chronic stroke survivors with partial or complete hand weakness showed significantly higher BBT score with an average of 8.6 blocks with the help of soft robotic glove.[2] The Hand Extension Robot Orthosis (HERO) Grip Glove study demonstrated that an average of 2.9 blocks (button mode) and 3.3 blocks (automatic mode) on the BBT was transferred with the robot-assisted mode using tripod pinch grasp from stroke survivors with limited active finger extension.[3] The findings from a Shi et al study stated that the subjects included with mild and moderate spasticity, by using electromyography driven soft robotic hand in rehabilitation training found that the soft robotic hand might be more beneficial in patients with mild hand spasticity .[4]

Conclusion: This study concluded that by using a soft robotic glove can assist a post stroke paretic hand in executing grasp, grip, and pinch functions among subacute and chronic stroke patients who have hand weakness but have sufficient proximal upper extremity strength to reach out with their arms.

The robotic glove design further can be refined with the help of this study to improve its functionality

References:

1. Boehme AK, Esenwa C, Elkind MS. Stroke Risk Factors, Genetics, and Prevention. Circ Res. 2017 Feb 3;120(3):472-495.
2. Thimabut W, Terachinda P, Kitisomprayoonkul W. Effectiveness of a Soft Robotic Glove to Assist Hand Function in Stroke Patients: A Cross-Sectional Pilot Study. Rehabil Res Pract. 2022 Apr 25;2022:3738219.

3. Yurkewich A, Kozak IJ, Hebert D, Wang RH, Mihailidis A. Hand Extension Robot Orthosis (HERO) Grip Glove: enabling independence amongst persons with severe hand impairments after stroke. J Neuroeng Rehabil. 2020 Feb 26;17(1):33.
4. Shi XQ, Heung HL, Tang ZQ, Li Z, Tong KY. Effects of a Soft Robotic Hand for Hand Rehabilitation in Chronic Stroke Survivors. J Stroke Cerebrovasc Dis. 2021 Jul;30(7):105812.

Effectiveness of Stroke Rehabilitation Treatment Using Cross-Modal Deep Learning: Evaluation Algorithm

Introduction: Impact of stroke on patients and their families are devastating, with long-term disability, depression, and economic loss during their most productive years lot of them affected struggle to combat. Substantial morbidity, mortality, and healthcare expenditures are associated with ischemic strokes affected in around 10 to 14% of adults aged 18 to 45 years.[1] In the treatment of stroke disease an effective way to evaluate the effect of stroke rehabilitation treatment and combining effects with a large number of evaluation results is an important link in optimizing the treatment scheme for the stroke disease.[2] The objective of the study was to analyse the stroke rehabilitation treatment effect from evaluation algorithm based on cross-modal deep learning.

Methods: To construct a multimodal evaluation dataset stroke patient's magnetic resonance images (MRI) and PET data were collected as evaluation data, and the data were divided into positive samples and negative samples. To generate the neural network model to recover the missing PET data the mapping relationship between MRI and PET, three-dimensional cyclic adversarial was used. the RGB image, depth image, gray image, and normal images of MRI and PET was taken as the feature images using the cross-modal depth learning network model and to fuse the feature images, output the recognition results of MRI and PET, and evaluate the effect of stroke rehabilitation treatment according to the recognition results the multi-feature fusion method was used.

Results: PET image in the dataset and the results of the missing PET image was recovered from the proposed algorithm (Figure 1). The recognition effect was found to be better within the database identified from the MRI data images of patients with normal behaviour, patients with progressive movement disorder, patients with stable movement disorder, and stroke patients (Figure 2). Ninety five percent was the recognition accuracy of the evaluation data and 98 % was the highest recognition accuracy from the algorithm (Figure 3).

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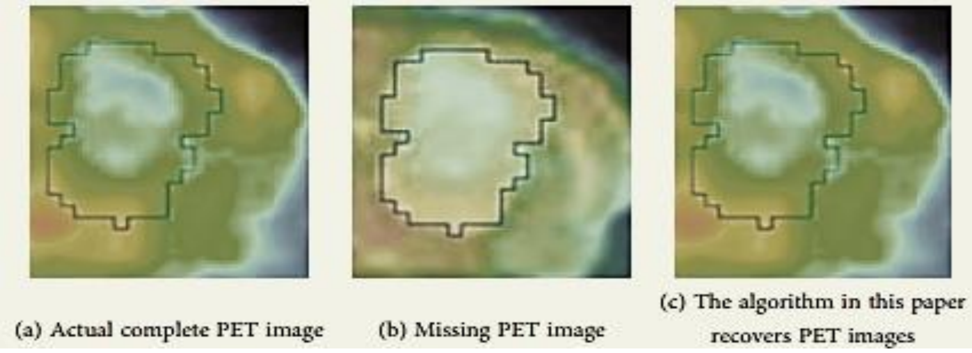
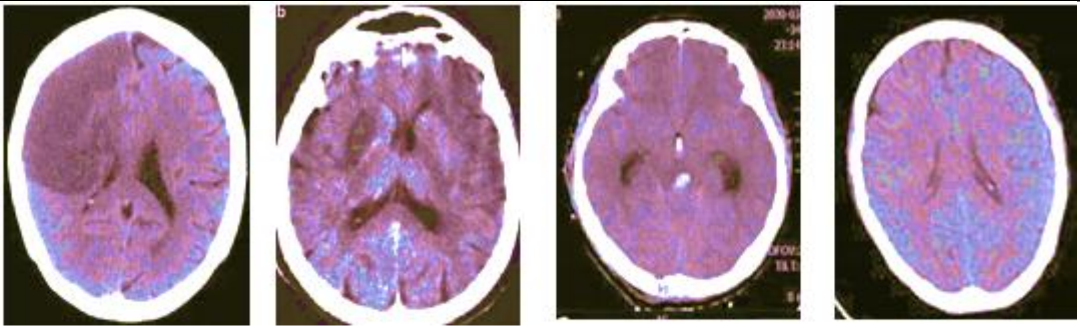


Figure 1. Restoration of PET image

Discussion: The evaluation time of the algorithm was short and more efficient which varied from 0.56 s to 0.91 s when compared to other algorithms from the literature.[2] Using the convolutional neural network (CNN) Zhang et al. stated that the sensory data of physical rehabilitation movement and body movement was obtained through the Gaussian mixture model (GMM) from the dynamic platform and from identification features of various



(a) Stroke patients (b) Stable mobility disorders (c) Progressive action disorder (d) Normal behaviour

Figure 2. Recognition effect of evaluation data

movements the improved lossless information compression algorithm was made. To evaluate the effect of each-rehabilitation training with the deep learning classifier different levels of hybrid CNN of sensor (S-CNN) and D-CNN were combined.[3] From the deep learning algorithm psychiatric risk and treatment effect was predicted by Shen et al. To pre-process massive feature data, to establish a high-order nonlinear interaction model between patient features and health implicit features, and to estimate the similarity between health implicit features by using the implicit feedback information oriented algorithm the deep collaborative filtering algorithm was used. Confidence of the feature vector was calculated, health implicit features from the training data set were learnt, and rehabilitation effect prediction system was constructed in the study to obtain accurate evaluation results from the back-propagation algorithm.[4]

Conclusion: The accurate and rapid evaluation of the effect of stroke rehabilitation treatment was identified from the study. The evaluation time varied between 0.56 s and 0.91 s and the accuracy of stroke rehabilitation treatment effect from evaluation was high with good practical application effect.

Addition of biomarker data and clinical diagnostic data the evaluation performance of stroke rehabilitation treatment effect can be improved in the near future

References:

1. Rosman L, Sico JJ, Lampert R, Gaffey AE, Ramsey CM, Dziura J, Chui PW, Cavanagh CE, Brandt C, Haskell S, Burg MM. Posttraumatic Stress Disorder and Risk for Stroke in Young and Middle-Aged Adults: A 13-Year Cohort Study. Stroke. 2019 Nov;50(11):2996-3003.
2. Wang L, Zhang R, Yu Q. Evaluation Algorithm for the Effectiveness of Stroke Rehabilitation Treatment Using Cross-Modal Deep Learning. Comput Math Methods Med. 2022 Apr 27;2022:5435207.
3. W. Zhang, C. Su, and C. He, “Rehabilitation exercise recognition and evaluation based on smart sensors with deep learning framework,” IEEE Access, vol. 8, pp. 77561–77571, 2020.
4. Shen B. M., Zhou X. P., Sun W. G. Study on psychosis risk prediction based on deep learning. Computer Simulation . 2020;37(10):417–420.

When Should You Look for a Genetic Cause of Stroke: Moyamoya Disease?

Introduction: Moyamoya is a rare disease (MMD) characterized by a progressive narrowing of the intracranial portions of the distal internal carotid artery (ICA) and the initial proximal components of the middle cerebral artery (MCA) and anterior cerebral artery (ACA) which is a chronic cerebrovascular disorder with disastrous consequences.[1] Because of its hereditary nature and the availability of new therapies MMD justifies a family assessment.[2] The study reported a case of a 42-year-old patient who was revealed by massive cerebral bleeding.

A 42-year-old unconscious patient with generalized convulsions was taken to the emergency department (ED). Patient had no history of allergies or addictions. High blood pressure and hypercholesterolemia were reported which were not treated and was presented with a history of stroke. The unconscious patient scored 3 with Glasgow Coma Scale (GCS). Urinary incontinence, tongue biting and anisocoria (left mydriasis) was observed. No other sensory-

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motor anomalies were seen in the postictal phase except lower right facial paralysis. Symmetrical blood pressure was 205/100 mmHg, heart rate was 95 bpm, a respiratory rate of 24 per minute and oxygen saturation of 99% upon examination. Temperature was 35.9°C and 1.25 g/l was patient's glycaemic index. The clinical picture was prompted intubation with

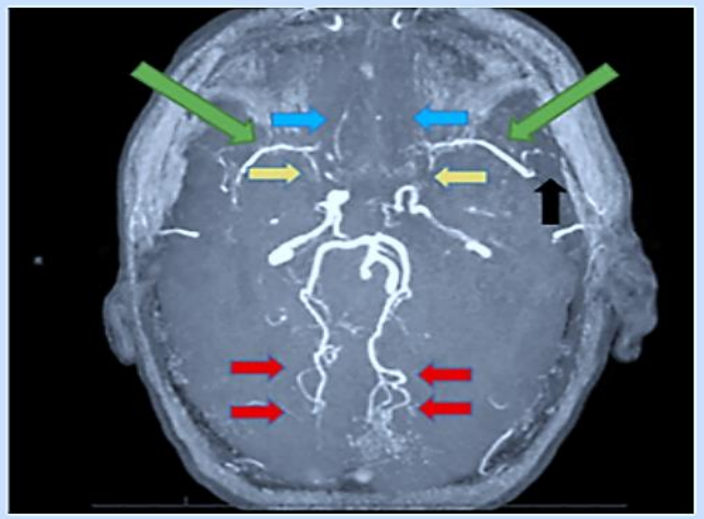

Figure 1. Cerebral angio-MRI confirming MMD from vascular abnormalities

succinylcholine and etomidate, followed by sedation with midazolam and sufentanil. Four gram of hypertonic salt serum (10%) was administered in light of the anisocoria indicating intracranial hypertension. Secondary brain injury factors indicated were monitored: permissive hypertension remained below 220/120 mmHg and maintained normocapnia and normoxia. Hypotensive therapy was not necessary. Cerebral flow on the left side (diastolic perfusion rate of zero), window on the right were absent which was confirmed from transcranial Doppler ultrasound (TCD). The presence of a large haematoma in the left hemisphere was confirmed two hours after the first symptoms had developed from cerebral magnetic resonance imaging (MRI) and was complicated by subfalcine and temporal engagements. The presence of MMD was confirmed from many vascular abnormalities (Figure 1). From collegial discussion decision was made to abstain from surgery with therapeutic regression due to rapid patient's deteriorated neurological state.

Genetic assessment of patient's children was made from prompted family history. Transmission modes were unknown, penetrance and symptomatology was variable. Identification of all pathological variants was not made.[2] In addition, investigation is complicated from involvement of environmental factors. The involvement of the RNF213 gene on chromosome 17 was widely accepted from genetic origin hypothesis. In the general East Asian population 1-2% of this variant was observed, the higher incidence of MMD in Asia was explained by this variant but its penetrance was low because of unaffected carriers. In MMD patients worldwide, other variants of RNF213 and rare variants in other genes was identified.[3]

Conclusion: MMD is a rare disease remains little known but increasingly well described. Without identified risk factors should motivate investigation of neurological symptoms in childhood and/or stroke at a young age. If imaging is suggestive, family screening including imaging and genetic assessment should be considered. Current therapeutic medicine offers various possibilities justifying a diagnostic work-up when the clinical and/or family suggests it. Therapeutic intervention for all familial cases may allow if a clear prognosis is adapted based on a genetic basis

Investigations should be carried out when the diagnosis is suspected and given the genetic nature of some forms of the disease the family members must be screened

References:

1. Berry JA, Cortez V, Toor H, Saini H, Siddiqi J. Moyamoya: An Update and Review. Cureus. 2020 Oct 16;12(10):e10994. doi: 10.7759/cureus.10994.
2. Van Overstraeten C. Moyamoya Disease: When Should You Look for a Genetic Cause of Stroke? Eur J Case Rep Intern Med. 2022 Apr 6;9(4):003298.
3. Mertens R, Graupera M, Gerhardt H, Bersano A, Tournier-Lasserve E, Mensah MA, et al. The genetic basis of Moyamoya disease. Transl Stroke Res 2022 Feb;13(1):25–45.