Brain Aneurysms: Isn’t Time to Review the Strategy for its Detection and Screening in Limited Clinical Environment and in the New Robotic Era?

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**Editorial**

Sophisticated medical technology including computer-assisted diagnosis softwares to improve the accuracy diagnostic imaging during the screening and investigation of unruptured brain aneurysms might benefit early diagnosis and population health outcomes [1-3]. This is because the increased of disponibility of new technological advances in the neuroimaging has made intracranial aneurysms screening easier and fashionable and at the same time allowing the increased number of brain aneurysms being diagnosed. However, based on literature data, the real prevalence of unruptured brain aneurysms varies tremendously from study to study and the current consensus regarding screening and detection is still very limited and certainly requires review [1-5].

Despite challenging task, a reasonable brain aneurysm visualization can be performed by noninvasive methods as magnetic resonance angiography (which identifies small aneurysms between 3 to 5 mm size) with up to 95% sensitivity and high accuracy when special sequences as volume rendering and 3D time-of-flight are performed or CT angiography which has good sensitivity for aneurysms larger than 3 mm [5]. This is making the DSA is no longer considered essential for screening and diagnosis of brain aneurysms [1]. Non-invasive methods are particularly recognised for screening of the high-risk brain aneurysmal populations e.g patients with genetic or collagen diseases, familiar occurrence or with history of multiple aneurysms or “minor” neurological symptoms including e.g chronic or recent headache or migraines like headache, visual acuity loss, cranial neuropathies, pyramidal tract dysfunction, pittitary clinical manifestations, atypical facial pain among others. Also, it has been used specially angiCT as routine after subarachnoid haemorrhage or follow-up of treated brain aneurysm [7-15].

Nevertheless, the main challenges still remain the correlation of imaging diagnosis within clinical symptoms and further understanding the aneurysm evolution history. In other words, the limited clinical environment is a reality in the most of the cases when it still not possible to measure the clinical symptoms impact associated with a lack of imaging biological markers. In addition, there is a true lacuna and lack of established strategies when an aneurysm is detected. New guidelines are needed in order to curtail inappropriate investigations once most of the cases doctors follows their own clinical medical judgment criteria which many times cause reflect problems of confidence in the protocols. After all, the aneurysms detection can cause levels of anxiety to the patient, confidence problems and therapy gap. As sometimes the clinical and radiological diagnosis are not made in the same time. We should think that not enough make the diagnosis but we should find think about implication on its treatment, prevention, identifying risk factors. So probably there is something else missed in the process that we need to review and still do not know well.

In the research environment, the study of aneurysmal biology has been highlighted particularly studies correlating the new endovascular treatments and investigating the role of hemodynamics and aneurysms morphology to assess the future risk of rupture has been designed [16-19]. Hemodynamic vesular tools have been used experimentally as markers for assessment of the aneurysmal biological process. Abnormality of intra-aneurysmatic blood flow patterns and arterial wall impingement zones as fragile points of the cerebral vasculature appear to be directly related to intracranial aneurysms and its natural history [18,19] and formation processes involved in the development and progression of intracranial aneurysms: its initiation; its growth; the inflammatory and degenerative processes related to the aneurysm’s rupture; and perhaps with its eventual recurrence [20,21]. Abnormal flow patterns have been demonstrated at flow bifurcation vascular angles or also associated with pathological conditions such as acquired or congenital asymmetry and anomalies of the circle of Willis, high flow arteriovenous malformation or after unilateral carotid artery ligation [22-25].

Morphological and geometrical factors have been recently identified and have been correlated with increased risk of aneurysm rupture. Dhar et al. [25] colleagues analysed 45 patients with sidewall aneurysms (25 unruptured and 20 ruptured) and morphological parameters as vessel and aneurysm angles and
it was founded eighty percent of all ruptured sidewall brain aneurysms had aneurysm angles greater than 112 degrees (the optimal threshold distinguishing the two groups), whereas 81.8% of all unruptured sidewall brain aneurysms had aneurysm angles less than 112 degrees to be statistically significant for rupture and to have good predictability was aneurysm angle, which is defined for sidewall aneurysms only. Other parameters are size ratio, carotid-ophthalmic location, multilobar ACA- accompanied (> bleeding risk), bony contact....The most known geometrical parameters are the size ratio and location which was described in the ISUIA [22-26].

The consolidation of robotic, research tools and clinical environment is perfectly feasible and could improve the detection and screening. New strategies aiming the improvement of clinical judgment including reviewed criteria should be dramatically and allow their use in the clinical settings.

References

1. Miki S, Hayashi N, Masutani Y, Nomura Y, Yoshikawa T, et al. (2016) Computer-assisted detection of cerebral aneurysms in MR angiography routine Image-Reading Environment: effects on Diagnosis by Radiologists. Am J Neuroradiol 37(6): 1038-1043.
2. Vernooy MW, Ikram MA, Tanghe HL, Vincent AJ, Hofman A, et al. (2007) Incidental findings on brain MRI in the general population. N Engl J Med 357(18): 1821-1828.
3. White PM, Wardlaw JM (2003) Unruptured intracranial aneurysms. J Neuroradiol 30(5): 336-350.
4. Li MH, Cheng YS, Li YD, Fang C, Chen SW, et al. (2009) Large-cohort comparison between three-dimensional time-of-flight magnetic resonance and rotational digital subtraction angiographies in intracranial aneurysm detection. Stroke 40(9): 3127-3129.
5. Van Gelder JM (2003) Computed tomographic angiography for detecting cerebral aneurysms: implications of aneurysm size distribution for the sensitivity, specificity, and likelihood ratios. Neurosurgery 53(3): 597-605.
6. Connolly ES Jr, Rabinstein AA, Carhuapoma JR, Derdeyn CP, Dion J, et al. (2012) Guidelines for the management of aneurysmal subarachnoid hemorrhage: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 43(6): 1711-1737.
7. Gorelick PB, Hier DB, Caplan LR, Langenberg P (1986) Headache in acute cerebrovascular disease. Neurology 36(11): 144.
8. Rinkel GJ, Djibuti M, Algra A, van Gijn J (1996) Prevalence and Risk of Rupture of Intracranial Aneurysms A Systematic Review. Stroke 29(1): 251-256.
9. Neil-Dwyer G, Bartlett JR, Nicholls AC, Narici P, Pope FM (1983) Collagen deficiency and ruptured cerebral aneurysms. A clinical and biochemical study. J Neurosurg 59(1): 16-20.
10. Pepin M, Schwarze U, Superti-Furga A, Byers PH (2000) Clinical and genetic features of Ehlers-Danlos syndrome type IV, the vascular type. N Engl J Med 342(10): 673-680.
11. Ronkainen A, Hernesniemi J, Punninen M, Niemitzukia L, Vanninen R, et al. (1997) Familial intracranial aneurysms. Lancet 349(9049): 380-384.
12. Raaymakers TW (1999) Aneurysms in relatives of patients with subarachnoid hemorrhage: frequency and risk factors. MARS Study Group. Magnetic Resonance Angiography in Relatives of patients with Subarachnoid hemorrhage. Neurology 53(5): 982-986.
13. Bromberg JE, Rinkel GJ, Algra A, van Duyn CM, Grebee P, et al. (1995) Familial subarachnoid hemorrhage: distinctive features and patterns of inheritance. Ann Neurol 38(6): 929-934.
14. Teasdale GM, Wardlaw JM, White PM, Murray G, Teasdale EM, et al. (2005) The familial risk of subarachnoid haemorrhage. Brain 128(Pt 7): 1677-1685.
15. Linn FH, Rinkel GJ, Algra A, van Gijn J (1996) Incidence of subarachnoid hemorrhage: role of region, year, and rate of computed tomography: a meta-analysis. Stroke 27(4): 625-629.
16. Mantha A, Karmonik C, Benndorf G, Strother C, Metacaffe R (2006) Hemodynamics in a cerebral artery before and after the formation of an aneurysm. Am J Neuroradiol 27(5): 1113-1118.
17. Sforza D, Putman CM, Cebrai JR (2009) Hemodynamic of Cerebral Aneurysms. Annu Rev Fluid Mech 41: 91-107.
18. Jeong W, Rhee K (2012) Hemodynamics of cerebral aneurysms: computational analyses of aneurysm progress and treatment. Comput Math Methods Med 2012: 782801.
19. Cebrai JR, Castro MA, Burgess JE, Pergolizzi RS, Sheridan MJ, et al. (2005) Characterization of cerebral aneurysms for assessing risk of rupture by using patient-specific computational hemodynamics models. Am J Neuroradiol 26(10): 2550-2559.
20. Meng H, Wang Z, Hoi Y, Gao L, Metaxa E, et al. (2007) Complex hemodynamics at the apex of an arterial bifurcation induces vascular remodeling resembling cerebral aneurism initiation. Stroke 38(6): 1924-1931.
21. Alderazi YJ, Shastrui D, Kass-Hout T, Prestigiacomo CJ, Gandhi CD (2014) Flow diverters for intracranial aneurysms. Stroke Res Treat 2014: 415653.
22. Brinjikji W, Murad MH, Lanzino G, Cloft HJ, Kallmes DF (2013) Endovascular treatment of intracranial aneurysms with flow diverters: a meta-analysis. Stroke 44(2): 442-447.
23. Lasheras JC (2007) The Biomechanics of Arterial Aneurysms. Annual Review of Fluid Mechanics 39: 293-319.
24. Zanaty M, Chaloubi N, Tjoumakaris S, Gonzalez F, Rosenwasser RH, et al. (2014) Aneurysm geometry in predicting the risk of rupture. A review of literature. Neurological Research 36(4): 308-313.
25. Dhar S, Tremmel M, Mocco J, Minsuok K, Yamamoto J, et al. (2008) Morphology Parameters for Intracranial Aneurysm Rupture Risk Assessment. Neurosurgery 63(8): 185-196.
26. Bozzetto Ambrosi P, De Vasconcelos CAC, Moret J, Spelle L, Valença, M M. (2016). Pathogenesis, haemodynamics and growth of intracranial aneurysms: future directions. The Anatomical Record: Advancing anatomy and evolutionary biology p. 1.