

ORIGINAL ARTICLE

Medicine Science 2021;(10):583-5

Contributions of Turkish neurosurgeons on the studies about autonomic nervous system dysfunction following experimental subarachnoid hemorrhage

 Bulent Ozdemir,  Osman Ersegun Baticik*Recep Tayyip Erdoğan Üniversitesi, Faculty of Medical, Department of Neurosurgery, Rize, Turkey*

Received 08 March 2021; Accepted 24 April 2021

Available online 11.05.2021 with doi: 10.5455/medscience.2021.03.074

Copyright@Author(s) - Available online at www.medicinescience.org

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.



Abstract

Spontaneous subarachnoid hemorrhage accounts for around 5% of all cases of stroke. Pathophysiologic autonomic nervous system changes have been frequently observed following SAH. In this paper, the interest of Turkish neurosurgeons in studies of autonomic nervous system dysfunction following experimental subarachnoid hemorrhage studies was analyzed. The searched terms “experimental subarachnoid hemorrhage”, “autonomic nervous system” was used for Pubmed search. 83 studies were analyzed. Many papers from Turkey were published (44 studies, 53% of all studies came from Turkey. Rabbits were the most preferred animals (in 48 studies, 57.8%). Neurosurgeons and neuroscientists from Turkey published many studies for autonomic nervous system dysfunction after SAH.

Keywords: The autonomic nervous system, dysfunction, subarachnoid hemorrhage, experimental

Introduction

An Epidemic of COVID 2019, SARS-CoV2 started in Wuhan, Hubei, in China at the end of December 2019 [1]. There is a report about the Subarachnoid hemorrhage (SAH)-producing effect of Covid-19 infection [1]. SAH accounts for around 5% of all cases of stroke. Its hemorrhage incidence has been reported as 10/100.000 people annually [2]. Pathophysiologic autonomic nervous system changes have been frequently observed following SAH. Brain is one of important organ of the human body. Brain injury may be seen occur following SAH which leads to significant morbidity and mortality. In addition, autonomic nervous system has important for the body. It is composed of many ganglions, plexi, cerebrospinal nuclei and nerves [3], and responsible for the vegetative functions [3] and the homeostasis of body. Blood pressure, gastrointestinal motility, glands, bladder functions, sweating and body temperature are controlled by autonomic nervous system [3]. Efferent autonomic signals are transmitted to various organs of the body by two major subunits called the sympathetic and parasympathetic

nervous system [4]. Tissue activity is increased or inhibited actively as a result of the functions of these two systems [4], but SAH causes autonomic nervous system dysfunction, which may have an important role in the pathogenesis of vasospasm following SAH [5]. Disruption of cerebral autoregulation has also been observed following SAH [6]. Vasospasm are still a important cause of poor outcome in patients [7]. The pathogenesis of the cerebral vasospasm is still not fully understood [8]. Many clinical and experimental studies have been performed in SAH [9]. The dysfunction of the autonomic nervous system after SAH has been studied by some researchers [10,11]. It can only be investigated in experimental studies. Animal SAH models have greatly contributed to our understanding of the the pathophysiology of SAH. Previously Ozdemir et al [12] reported the contributions of Asian scientist on the experimental SAH studies, but the effect of Turkish neurosurgeons has not been studied. This study aims this subject.

Materials and Methods

A systematic Pubmed analysis was made by using terms “experimental subarachnoid hemorrhage”, “autonomic nervous system”. Studies written in English were analyzed. All studies about experimental SAH studies about autonomic nervous system dysfunction were included. Systematic reviews, meta-analyses, and human studies were excluded.

*Corresponding Author: Bulent Ozdemir, Recep Tayyip Erdoğan Üniversitesi, Faculty of Medical, Department of Neurosurgery, Rize, Turkey,
E-mail: bulent.ozdemir@erdogan.edu.tr

Results

All animal studies between 1972 and 2021 about autonomic nervous system dysfunction following experimental SAH were analyzed, 83 studies were found and analyzed. Many publications from Turkey were noted (44 studies, 53% of all studies came from Turkey).

Analyzing of Ranking of Published Studies

Ranking of countries

1. Turkey (44 studies, 53.0% of all studies)
2. Japan (12 studies, 14.4 % of all studies)
3. USA (5 studies, 6 % of all studies).

Animals

Rabbits were the most preferred animals (in 48 studies, 57.8%).

Discussion

In this study, it was observed that many publications appeared from Turkey. To the best of our knowledge, this is the first study to analyze the contribution of Turkish Neurosurgeon to autonomic nervous system dysfunction in experimental studies.

What is the reason to prefer the experimental studies?

Tissue changes after SAH can only be seen in experimental studies [13]. The blood in the subarachnoid space after SAH produces early and late brain injury this injury. Neuronal death occurs. In human studies, it is not impossible to clarify to examine the neuronal death, without tissue examination. For that reason, experimental studies have significant roles in SAH. There are many experimental animal models of SAH [14]. Various animals such as mouse, rat, rabbit, cat, dog, and monkey have been used. Large animals such as dogs and primates have been preferred [14]. In particular, primates have similarities in their brain structure to humans [14]. In literature, the rat model has mentioned as one of the most utilized animal models of SAH [14,15], likely due to low cost and ability to use large numbers of animals. There is report that increasing of using the rat model in researches of experimental SAH studies [6]. However, in this study, it was observed that rabbits were the most preferred animals (in 48 studies, 57.8%). In rabbits, the surgical procedures are easier to perform as compared with small species such as rats.

In these studies, several SAH producing techniques have been used such as the puncture or perforation of a cerebral vessel has been performed [14] or injection of blood into a cistern [14]. Each model has advantages and disadvantages to simulate human SAH. Because SAH is a complex neurovascular disease, there are no ideal experimental SAH models that perfectly recapitulate all of the clinical aspects of the human SAH [16]. Various drugs showed good results in experimental animal studies. However, oral nimodipine remains the only drug to improve neurological outcome in SAH patients [17].

Limitation

One of the limitation is that, experimental animal SAH models do not adequately mimic the acute human pathophysiology [2].

Appropriate animal models that mimic at least some features of human SAH would undoubtedly improve understanding of SAH.

Conclusion

Neurosurgeons and neuroscientists from Turkey contributed many papers for autonomic nervous system dysfunction following SAH. More studies are required for investigating this subject.

Conflict of interests

The authors have no conflict of interest to declare

Financial Disclosure

All authors declare no financial support.

Ethical approval

The paper is retrospective literature research, for that reason, ethical approval is not required.

References

1. Batcik OE, Kanat A, Cankay TU et al. COVID-19 infection produces subarachnoid hemorrhage; acting now to understand its cause: A short communication. Clin Neurol Neurosurg. 2021;202:106495.
2. Kepoglu U, Kanat A, Aydin MD et al. New histopathologic evidence for the parasympathetic innervation of the kidney and the mechanism of hypertension following subarachnoid hemorrhage. J Craniofac Surg. 2020 ;31:865–70.
3. Akyuz G, MA L. Autonomic Nervous system anatomy and its assesment. Turk J Phys Med Rehab. 2012;58:1–5.
4. Saracoglu KT, Baygin O. Autonomic nervous system and anesthesia, J Anesthesia - JARSS 2015;23:194-200.
5. Aydin MD, Kanat A, Aydin N et al. New evidence for causal central mechanism of hyperglycemia in subarachnoid hemorrhage secondary to ischemic degenerative disruption of circuitry among insular cortex, nodose ganglion, and pancreas. Experimental study. World Neurosurg. 2017;106:570–7.
6. Neulen A, Molitor M, Kosterhon M et al. Correlation of cardiac function and cerebral perfusion in a murine model of subarachnoid hemorrhage. Sci Rep. 2021; 11:3317.
7. Yilmaz A, Aydin MD, Kanat A et al. The effect of choroidal artery vasospasm on choroid plexus injury in subarachnoid hemorrhage: experimental study. Turk Neurosurg. 2011;21:477–82.
8. Ozdemir NG, Aydin MD, Yolas C, et al. Predictive role of external carotid artery vasospasm on cerebral ischemia after subarachnoid hemorrhage: Experimental study. Turk Neurosurg. 2017 ;27:874–83.
9. Aydin MD, Kanat A, Yolas C New. Insights of the fever following subarachnoid hemorrhage and introducing a new thermoregulator like structure in choroid plexuses; preliminary study. Acta Neurol Taiwan 2019;28:1–11.
10. Aydin MD, Kanat A, Yolas C et al. Spinal subarachnoid hemorrhage induced intractable miotic pupil. A reminder of ciliospinal sympathetic center ischemia based miosis. An experimental study. Turk Neurosurg. 2019;29:434–9.
11. Findik H, Kanat A, Aydin MD et al. Describing a new mechanism of retinal detachment secondary to ophthalmic artery vasospasm following subarachnoid hemorrhage. An experimental study. J Neurol Surg A Cent Eur Neurosurg. 2019;80:430–40.
12. Ozdemir B, Kanat A, Ozdemir V. The effect of neuroscientists on the studies of autonomic nervous system dysfunction following experimental subarachnoid hemorrhage. J Craniofac Surg. 2019;30:2184–8.
13. Ozdemir B, Kanat A, Kazdal H. Experimental brain injury models experimental brain injury models. Turk Norosirurji Derg. 2020;30:308–11.

14. Daou BJ, Koduri S, Thompson BG et al .Clinical and experimental aspects of aneurysmal subarachnoid hemorrhage. *CNS Neurosci Ther.* 2019;25:1096–112.
15. Marbacher S, Grüter B, Schöpf S et al. systematic review of in vivo animal models of subarachnoid hemorrhage. Species, Standard Parameters, and Outcomes. *Transl Stroke Res.* 2018
16. Dinh DD, Lidington D, Kroetsch JT et al. Experimental subarachnoid hemorrhage drives catecholamine-dependent cardiac and peripheral microvascular dysfunction. *Front Physiol.* 2020;11:402.
17. Kamp MA, Steiger H-J, Van Lieshout JH. Experimental Aneurysmal Subarachnoid Hemorrhage: Tiding Over. *Transl Stroke Res.* 2020;11:1-3.