Comparative analysis of cognitive function at vascular complications of migraine. Diagnosis and clinical approach

Matlyuba Sanoeva[*], and *Gulova* Munisakhon

Department of Neurology, Bukhara State Medical Institute, Bukhara, Uzbekistan

Abstract. Migraine affects 11-15% of the adult population, frequent and prolonged migraine attacks, untimely correction, the absence of preventive measures can form vascular complications with the development of cognitive dysfunctions. The aim of this study was to study and analyze cognitive function in various variants of the course of complicated migraines in a comparative aspect. We studied 378 (100%) patients with various options for the course of migraine. Of these, 78 (20.6%) examined with migraine status, 82 (21.7%) with chronic migraine, 52 (13.8%) with migraine strokes, 87 (23.0%) chemoprophylaxis with migraine, considered as the main group, and the comparative group included 79 (20.9%) patients with uncomplicated migraine. The study demonstrate that cognitive dysfunction complicated by migraine develops due to cerebral vascular reactions modelled on vasodilation / vasoconstriction against the background of migraine attacks that cause hypoxia and then local ischemia with the formation of encephalomalacia in "strategic areas" and can be considered as a predisposition of patients with migraine to vascular dementia.

1 Introduction

Modern medicine, along with various problems of somatic and neurological genesis assigns significant role in the study of brain manifestations. One of the not the last, and in some cases, the main representatives of which is *cognitive dysfunction* (CD) is increasingly turning into an epidemic of modernized medicine. CD partly causes a reduced quality of life, social activity, human communication in society, disconnection from relatives, family and the environment. Increasingly, this pathology attracts the attention of specialists of different profiles, because along with increased life expectancy the problem of preserving intellectual function becomes the most urgent, so all efforts to increase human life expectancy must be backed by work on the preservation of cognitive potential (Barulin, 2016). According to several authors, from 5 to 25% or more of those over 65 years of age suffer from dementia, in absolute numbers which is at least 30 million patients in the world (Levin, 2006).

The CD in most cases develops in the background of chronic vascular disorders of the brain, one of the representatives of which is migraine. Migraine affects 11-15% of the adult

---

[*] Corresponding author: matlyubadoct70@mail.ru

population (Stovner et al., 2007; Vos et al., 2012; Golovacheva et al., 2018). Frequent and prolonged migraine attacks, untimely correction of them, lack of preventive measures can lead to the formation of vascular complications with the development of CD. The prevalence of migraine in the adult population in Europe is 14% (Stovner et al., 2006), in China - 9.3% (Yu et al., 2012), in the U.S. - 20.2% (Burch et al., 2015) in Russia - 20.3% (Ayzenberg et al., 2012; Bigal & Lipton, 2009). Such statistics are really alarming regarding the spread of vascular dementia, if we consider that migraine is a risk of developing chronic cerebrovascular pathology.

Many researchers point to an objective cognitive decline in patients with migraine, while others, on the contrary, report a lack of such in migraines (Golovacheva et al., 2018). Moreover, over the past decade, clinical evidence has been obtained that patients with migraine have an increased risk of developing stroke, arterial hypertension and diabetes mellitus are more common (Ott et al., 1998; Scher et al., 2009; Schurks et al., 2009). High prevalence of migraine in the general population, especially in women (Stovner et al. 2007), and the data on that the female sex is a risk factor for stroke, dementia (Miche, 2016; Ott et al., 1998), and migraine is a risk factor for the development of cardiovascular events and stroke (Kruit et. al., 2004; Kurth et. al., 2006; Kurth et. al., 2010; Kurth et. al., 2011), the effect of cerebrovascular diseases on the development of CD (Kruit et. al., 2004; Miche, 2016), the detection of damage of the white and, to a lesser extent, gray matter of the brain of patients with migraine during MRI (Vermeer et al., 2003; Scher et. al., 2009; Kurth et. al., 2011), age as a risk factor for the development of CD against the background of an increased life expectancy in modern world (Miche, 2016) - all this determines the important role in reducing migraine cognitive functions, as well as the conditions under which patients with migraine have an increased risk of developing CD. The CD in patients with migraine is also associated with comorbid disorders (depression, anxiety disorder) (Levin, 2006), which has been proved in previous publications of the author of this paper (Sanoeva et. al., 2018). Consideration the nature of CD in migraines will help to develop optimal principles for their treatment and prevention.

Based on all of the above, the purpose of this study was to study and analyze cognitive function in various variants of the course of complicated migraines.

2 Material and methods

Overall, 378 patients (100%) were examined with different migraine variants. Of which, 78 patients (20.6%) surveyed with migraine status, 82 patients (21.7%) with chronic migraine, 52 patients (13.8%) with migraine strokes, 87 patients (23.0%) with *chronic brain ischemia* (CBI) in the background of migraines were considered as the main group, and 79 patients (20.9%) with *uncomplicated migraine* (UCM) analyzed as a comparison group. We studied attention, memory with their varieties and speed of information processing which assessed the level of thought ability in the survey group. As a method, the study used more sensitive psycho-diagnostic samples, comparing the results with a comparative group. To study concentration and stability of attention we used a corrective sample; to assess them by degrees of decline we used the method of M.Kononova; to study the diversion of attention we used the Gorbova-Schulte table; and the volume and distribution of attention was assessed by the Krepeline score (Gimoyan & Silvanyan, 2013). To assess short-term memory, a mini-Cog test was conducted, and long-term memory was investigated by Luria's method of memorizing 10 words (with several words repeated (up to 15 times) and after 7-10 days of re-consultation checked their memorization). The most informative to determine the violation of the speed of processing information and distraction was the test conducted on the table Schulze - the stimulant material served as 5 black-and-white tables of square shape, on which numbers from 1 to 25 were randomly placed. The patient pointed the numbers at the table

and called them out loud. Using a stopwatch, we recorded the time spent on each table and the number of errors made. For the norm, the average task execution time was considered to be 30-40 seconds and up to 5 errors. Skipping numbers, showing instead of one digit by another, increasing the number of errors in the last 3 tables meant a decrease in the speed of information processing.

3 Results and discussion

The analysis showed that almost half patients (43.7%) with migraine suffered from a *high-level brain dysfunction* (HLBD) of varying degrees of severity. Thus, patients with complicated migraines during the corrective test were observed a decrease in attention concentration in the form of skipping individual letters or lines and striking out other, nearby letters, similar changes in migraine status and chronic migraines were intermittent, mainly during attacks, and in patients with migraine stroke and CIB against the background of migraine were detected regardless of the presence of migraine paroxysms. By the distribution of errors (the uniformity of them throughout the experience) determined the state of attention stability, which often decreased by the end of the experiment and reached from 18 - 20 to 24 - 26. It should be noted that the experiment was considered normal when conducting it for 6 to 8 minutes.

In contrast to the corrective sample, the Kononova method determined the degree of concentration and stability of attention (based on errors of writing the name of figures and drawings, their sequence, the time of the experience). The decrease in attention switching was characterized by the replacement of the order of naming numbers, the change of its serial number, the replacement of color, the lengthening of the time of the test. To determine the volume and distribution of attention on the account of Krepeline, the subject put together unambiguous numbers in his mind, the results were estimated by the number of numbers folded, at a certain time and mistakes made. We evaluated 2 types of errors: 1 - errors in units, when going through a dozen, and 2 - errors in dozens, while paying attention to the volume of pauses between executions. The results of the study are given in Table 1.

Table 1. Changing attention in patients with complicated forms of migraine.

	Corrective test Kononova Method						Gorbova-Schulte Table			Crepeline's count	
	Concentration (%)			Attention resilience (%)			Reduced attention switching (%)	Time		Reducing of Attention volume (%)	Sharing attention (%)
	Average level	Low level	Very low level	60%	50%	20%		Start	finish		
MS	26,9			18,0			11,5	1'50"	3'00'	10,3	21,3
	10,3	8,9	7,7	10,3	7,7	5,1					
ChM	31,7			31,7			15,9	1'40"	3'30'	15,9	23,2
	7,3	13,4	11,0	7,3	13,4	11,0					
Migraine Stroke	51,9			55,7			30,8	3'30"	4'00'	32,7	73,1
	17,3	23,1	11,5	7,7	25,0	23,1					
CIBM	86,7			86,7			32,8	2'50"	3'30'	36,8	60,9
	35,6	40,2	13,8	35,6	40,2	13,8					

Continuation of Table 1.

UCM	13,9			8,9			-	0'75"	0'95"	8,9	15,2
	10,1	3,8	-	8,9	-	-					

Note: MS migraine status; ChM-chronic migraine; MStr-migraine stroke; CIBM-chronic ischemia of brain against background of migraine; UM-uncomplicated migraine
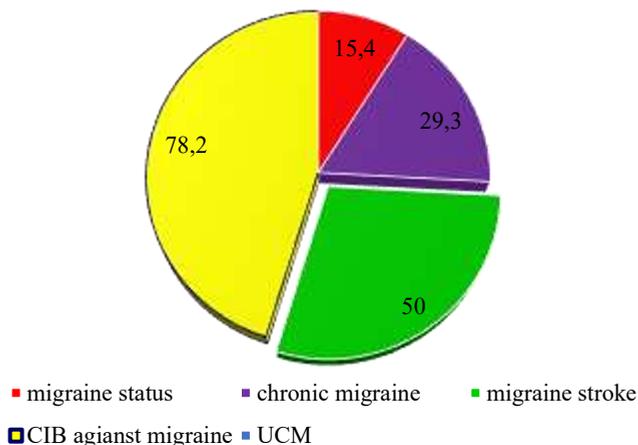
Source: Compiled by the author on the basis of own research

As shown in Table 1 Low attention span with resistance of 50% mostly observed in patients with chronic migraine and CIB against the background of migraine, a very low degree of attention concentration with 20% resistance was characteristic for patients with migraine strokes. The decrease in attention span between groups of patients with migraine status and chronic migraine was almost the same, with no statistical difference, while a 1.8-fold decrease in attention resistance ($p<0,05$) was more common in chronic migraine, with an increase in errors by the end of the experience from 22-24 to 27-28, the time of the experience reached 9 minutes, exceeding the established norm by 1.3 times ($p<0,01$), in contrast to this with migraine status, the number of errors reached 25-26, and the time of conduct experience did not exceed 8 minutes 20 seconds. Errors in the sample were characterized by missing individual letters, lines, striking out nearby, similar letters in both groups. In migraine strokes, the duration of the experiment was delayed to 14 minutes, the resistance of attention in contrast to the two previous groups was weak from the beginning of the experiment. Patients missed whole lines, crossed out nearby, or similar to them by writing letters. The decrease in attention span exceeded 1.9 times compared to migraine status and 1.6 times compared to chronic migraine. In THE case of CIB against the background of migraine, attention resistance was weak initially, as in migraine stroke, the time of corrective test was delayed to 11 minutes. Initially, errors differed by a scattered type, like a migraine stroke, the researchers missed the questioned, single letters, the mistakes made reached 29-30. By the end of the job, they tried to focus on addressing the situation, which required wasting time. Concentration in contrast to previous groups was reduced in almost all patients examined by CIB against the background of migraine. When compared in contrast to the main group in patients with UCM, the decrease in attention was detected in the form of skipping individual letters in isolated cases, with frequent and prolonged migraine attacks (up to 6 times a month), the number of errors did not exceed acceptable standards (before 16). Reduced attention resistance was observed in 7 (8.9%) patients with UCM, which has been associated with absent-mindedness during migraine attacks.

According to the Gorbova-Schulte table, the statistical difference between the decreased in switching attention in groups of patients with migraine status and chronic migraine was not revealed, while in migraine strokes it exceeded 2.7 times compared to migraine status and doubled compared to chronic migraine. In patients with CIB against the background of migraine it was 2.9 times more often observed than in migraine status and 2.1 times more often than in chronic migraine. The time allotted for the sample compared to the comparison group exceeded 3 to 4 times. The longest time was in patients with migraine strokes, reaching up to 4 minutes (table 1). Patients with migraine stroke ($p<0.05$) and CIB suffered more in the background of migraines ($p<0.05$). As shown, impaired concentration, attention and depletion were observed in patients in the main group, but unlike migraine status and chronic migraine with CIB against the background of migraine and migraine strokes, similar changes were more pronounced and persistent ($p<0.05$).

The mini-Cog test (Figure 1) was used to study short-term memory. According to the analysis of the test on the first stage, patients with migraine status received an average of 2.7 points, on the second task (drawing on paper the dial of the clock round shape with arrows, and setting a set time with three attempts) 8 (10.3%) patients failed, in the third task patients were asked to recall the words that were uttered to him in the first stage and 14 (18.0%) of those surveyed could not remember the words spoken. According to this method, 12 (15.4%)
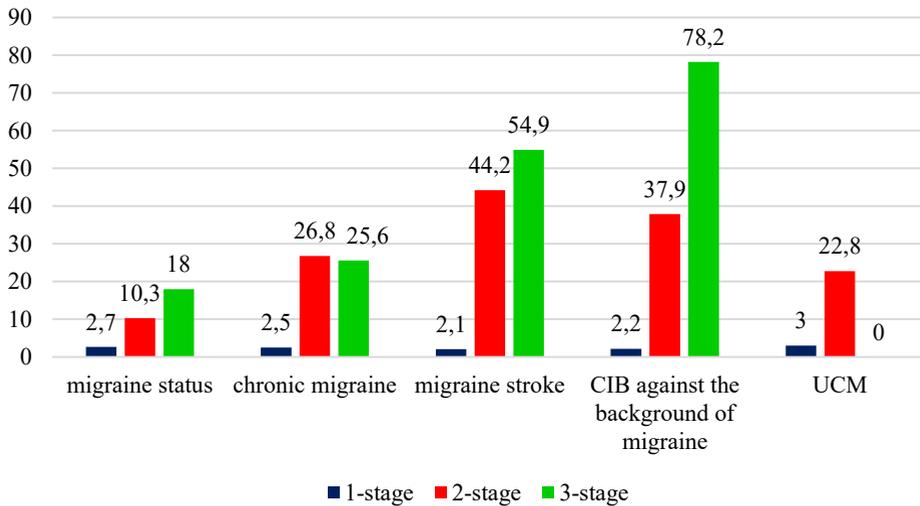
patients with migraine status who failed in at least two tasks were considered predisposed to vascular dementia. Patients with chronic migraine in the first stage received an average of 2.5 points, on the second task 22 (26.8%) surveyed could not cope with the task, 2.6 times higher than the number of patients with migraine status (p<0.05). In the third assignment 21 (25.6%) of those surveyed, they could not recall the words originally spoken, the number was 1.4 times greater than for migraine status (p<0.01). 24 (29,3%) patients were considered predisposed to vascular dementia, the number of which was 1.9 times higher than patients with migraine status (p<0.05). In migraine strokes, patients received an average of 2.1 points, with the second task 23 (44.2%) surveyed did not cope, which was 4.3 times more than in migraine status, and 1.7 times more than in chronic migraine. 28 (54,9%) of those surveyed could not remember the initial words that three times the number of patients with migraine status and 2 times chronic migraine. According to this method, 26 (50.0%) patients were considered predisposed to vascular dementia, which was 3.3 times the number of patients with migraine status (p<0.05), and twice with chronic migraine (p<0.05). In CIB against the background of migraine patients received an average of 2.2 points, which was not statistically different from a migraine stroke. On the second task, 33 (37.9%) had a view. the number of errors, the number of which was 3.7 times greater than in migraine status, was 1.4 times more than in chronic migraine and was not statistically different from migraine stroke. In the third assignment, the patient was asked to recall the words he had spoken in the first stage and 68 (78.2%) of those surveyed could not remember them. Mini-Cog 67 (77.0%) patients were considered predisposed to vascular dementia, the number of which was 5 times greater than in migraine status, 2.6 times more than in chronic migraine, and 1.6 times more than in migraine stroke. Figures 1, 2 show the results of the mini-Cog test. The average score for mini-Cog testing in UCM patients was 3.0 points, i.e. it was not different from the accepted norm. In the second stage 18 (22.8%) patients during migraine paroxysms could not respond and pass the test, but after cupping the attacks were examined, and the pathology of short-term memory was not detected. Using a 10-word test on Luria and checking the amount of memorization after 7-12 days assessed the structure of long-term memory (Figure 3). A high level of long-term memory ratio from 75 to 100% was found in 36 (46.2%) patients with migraine status, with an average rate from 50 to 75% observed in 22 (28.2%) patients, low rates with a ratio of 30-50% were noted in 14 (17.9%) patients, a very low level of up to 30% was typical for 6 (7.7%) of surveyed who recalled only 2-3 words.

Fig. 1. Number of patients with complicated migraines predisposed to vascular dementia on mini-Cog test.
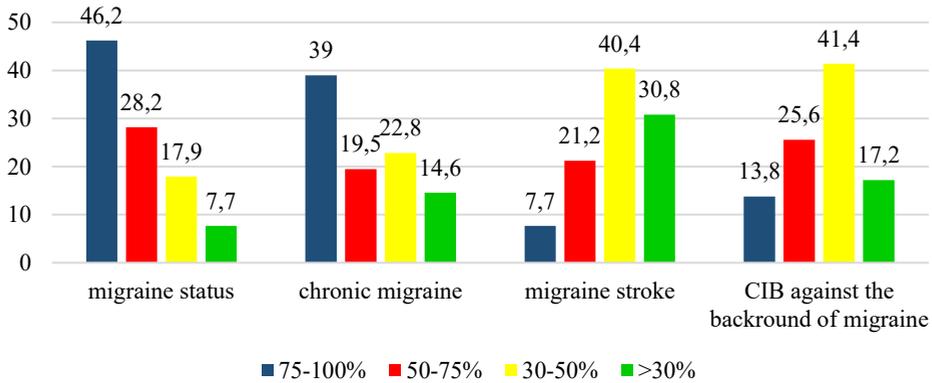Source: Compiled by the author on the basis of own research.

In chronic migraine, a high level of long-term memory was determined in 32 (39.0%), the average level of 16 (19.5%), low level in 22 (22.8%), and very low level in12 (14.6%) patients. The total number of patients with decreased in long-term memory had no reliable differences from migraine status, with the only difference being that low levels of declined memory were 1.5 times higher in chronic migraines ($p<0.01$). In migraine stroke, a decreased in long-term memory was observed in 48 (92.3%) patients which is 1.6 times higher than the number of patients with chronic migraines and 1.7 times with migraine status. Thus, a high level of long-term memory ratio was found only in 4 (7.7%) surveyed, the average level is 11 (21.2%), low in 21 (40.4%), and very low in 16 (30.8%) migraine stroke patients.

Fig. 2. Phased test results of mini-Cog examined patients with migraine.
Source: Compiled by the author on the basis of own research.

In CIB, against the background of migraine, the decrease in long-term memory was typical for 75 patients (86.2%), which exceeded 1.6 times migraine status, 1.5 times chronic migraine and statistically did not differ from migraine stroke. A high level of long-term memory ratio showed 12 patients (13.8%), average level 24 patients (25.6%), low level 36 patients (41.4%), very low level 15 patients (17.2%) examined. Low levels of long-term memory impairment in CIB against the background of migraine 2.3 times prevailed over migraine status, 1.6 times over chronic migraine, and statistically did not differ from migraine stroke. In UCM, as a comparative group of pathological changes in long-term memory were not observed, and some changes were within the acceptable physiological norm. Figure 2 shows that the results of comparisons between three comparable groups of complicated migraines showed more severe changes in cognitive function in migraine stroke and CIB against the background of migraine.

Fig. 3. Long-term memory comparison results in complicated migraine forms.
Source: Compiled by the author on the basis of own research.

Processing speed (PS) as a key element for learning, academic, intellectual development, thinking, learning, the level of mental problem solvability, thinking abilities, learning through vision and hearing, which investigated using the Schulze table. Lengthening of time spent on each table, mistakes made, skipping numbers, showing instead of one digit another, which determined the absent-mindedness of attention revealed in 18 patients (23.1%), an increase in the number of errors in the last three tables was observed in 21 patients (26.9%) of the examined, which showed a decrease in PS, i.e. the level of mental depletion in patients with migraine status. In chronic migraine, distracted attention was observed in 18 patients (22.0%), a decreased PS with exhaustion of mental activity in 24 patients (29.3%); with a migraine stroke, these indicators were 36 patients (69.2%) and 33 patients (63.5%), respectively. In chemotherapy, against the background of migraine, 57 (65.5%) showed a lack of attention and 64 patients (73.6%) showed a decreased PS with poor mental activity. With UCM, a temporary decrease in PS was observed in 12 patients (15.2%) associated with a seizure period.

The study of cognitive function of the brain in complicated migraine proves that migraine attacks cause cerebral vascular reaction by the type of vasodilation/vasoconstriction, which causes hypoxia, and then local ischemia with the formation of encephalomalaising in the "strategic zones" of the brain, which explains the development of cognitive dysfunction and can be considered as a predisposition of patients with this pathology to vascular dementia. The results of the study were compared and, when combined with several symptoms, CDs identified different degrees of cognitive impairment according to the classification proposed by the academician N.N. Yahno (2006) (table 2). As shown in Table 2, in complicated forms of migraines were mostly observed light and moderate degrees of CD, while in migraine stroke and CIB against the background of migraine, they were more common than in migraine status and chronic migraine, which was statistically significant character ($p<0.001$). The comparison group identified a small number of patients with mild cognitive impairment shall be associated with the onset of the disease.

Cognitive impairment was correlated with the frequency, intensity of headaches and the duration of the disease itself. It should be noted that the presence of aura did not affect the frequency of cognitive impairment. Identified "strategic" pockets did not always explain the clear localization of cognitive impairment, i.e. did not correlate with the identified symptoms, which proves the transient angiodistonia in various vascular basins.

Table 2. Degrees of cognitive impairment in complicated forms of migraine (in %).

Degrees of CD	Clinical signs	MS	ChM	MS	CIB migraine	UCM
Light degree (Minimal cognitive deficit)	Fully oriented, performs psychological tests well (memory, complex instructions), but there is a certain decrease in attention span, mental performance, memorization of new material	28,2	20,7	32,8	35,6	8,9
Moderate degree	Periodically confused in time and space; there is a moderate decrease in RAM, and errors are made when following two-pronged instructions.	15,4	29,3	50,0	78,2	-
Expressed degree	Dementia: there are varying degrees of memory and intellectual impairment combined with varying degrees of social disadaptation	-	-	-	-	-

Note: MS migraine status; ChM-chronic migraine; MS-migraine stroke; CIB M-chronic ischemia of the brain against the background of migraines; UCM-uncomplicated migraine

Source: Compiled by the author on the basis of methodology of Yakhno (2006)

4 Conclusion

Thus, analyzing and comparing the obtained results can confirm that cognitive dysfunction in complicated forms of migraine has a vascular character, depending on the duration of the disease, the frequency and intensity of headaches and the duration of the migraine attacks itself. Summarizing the results of cognitive function in patients of the examined groups, we can do conclusion that:

1) Pathological reactive state of cerebral hemodynamics at the time of attacks of hemikrania, as a consequence of inhibition of behavioral reactions is the cause of vascular pathology, affecting the structural and functional state of the brain. The available variety of cognitive disorders in migraine complications proves that there is no clear localization of damage to a certain vascular pool.

2) Complications of migraine are the cause of vascular cognitive disorders, determining the level of "non-dementia" or "moderate cognitive disorders";

3) Lack of timely correction of cognitive disorders, along with the underlying disease can cause the formation and direct predisposing factor of vascular dementia with severe consequences.

4) Cognitive dysfunction in complicated migraines can lead to uneven damage to executive functions, a significant reduction in professional and domestic skills, and ultimately be the cause of deep disorganization of patients.

References

1. I. Ayzenberg, Z. Katsarava, A. Sborowski et al., Cephalalgia **32(5)**, 373-81 (2012)

2. Sh. F. Bakhodirova, G. A. Ikhtiyarova, M. J. Aslonova, S. S. Davlatov, European Journal of Molecular & Clinical Medicine **7(2)**, 6350-6356 (2020)

3. J. J. Bakhronov, S. J. Teshaev, M. S. Shodieva, International Journal of Pharmaceutical Research **13(1)**, 683-686 (2020)

4. A. G. Bozorov, G. A. Ikhtiyarova, S. S. Davlatov, International Journal of Pharmaceutical Research **12**, 4894–4897 (2020)

5. S. S. Davlatov, B. Z. Khamdamov, Sh. J. Teshaev, Journal of Natural Remedies **22(1(2))**, 147-156 (2021)

6. S. Davlatov, K. Rakhmanov, N. Qurbonov, I. Vafayeva, D. Abduraxmanov, International Journal of Pharmaceutical Research **12**, 1931-1939 (2020)

7. S. Davlatov, K. Rakhmanov, S. Usarov, F. Yuldoshev, U. Xudaynazarov, J. Tuxtayev, International Journal of Pharmaceutical Research 12, 1912-1921 (2020)

8. S. Davlatov, Sh. Teshayev, X. Fayziev, N. Khamidova, International Journal of Pharmaceutical Research **13**, 970-976 (2020)

9. F. Nurutdinova, Z. Tuksanova, Y. Rasulova, E3S Web of Conferences **474**, 01002 (2024)

10. G. A. Ikhtiyarova, N. K. Dustova, M. A. Khasanova, G. S. Suleymanova, S. S. Davlatov, International Journal of Pharmaceutical Research **13(1)**, 1935-1942 (2021)

11. B. Z. Khamdamov, S. I. Azimov, Sh. T. Mukhtarov, Z. R. Rashidov, F. I. Aslonov, S. S. Davlatov, Journal of Natural Remedies **22(1(2))**, 117-123 (2021)

12. S. S. Davlatov, B. Z. Khamdamov, Sh. J. Teshaev, Journal of Natural Remedies **22(1(2))**, 147-156 (2021)

13. B. Z. Khamdamov, A. A. Ganiev, I. B. Khamdamov, Journal of Survey in Fisheries Sciences **10(2S)**, 3949-3958 (2023)

14. B. Z. Khamdamov, U. P. Hamroev, I. B. Khamdamov, Europe's Journal of Psychology, 123-127 (2021)

15. B. Z. Khamdamov, T. Y. Musoev, F. N. Khaidarov, K. U. Gaziev, Europe's Journal of Psychology, 91-101 (2021)

16. K. E. Rakhmanov, S. S. Davlatov, D. Sh. Abduraxmanov, International Journal of Pharmaceutical Research **13**, 4044- 4049 (2020)

17. M. J. Sanoeva, G. B. Juraeva, G. Kh. Mukhidova, Journal of New Day in Medicine **3(23)**, 83-90 (2018)

18. M. Sanoeva, S. Farruh, I. Amrillo, M. Gulova, M. Avezova, Journal of Critical Reviews **7(3)**, 425-430(2020)

19. M. J. Sanoeva, Journal of Pharmaceutical Negative Results **13** (2022)

20. A. M. Shamsiev, Zh. A. Shamsiev, K. E. Rakhmanov, S. S. Davlatov, Experimental and Clinical Gastroenterology **174(5)**, 72-77 (2020)

21. S. J. Teshaev, R. R. Baymuradov, N. K. Khamidova, D. A. Khasanova, International Journal of Pharmaceutical Research **12(3)** (2020)

22. S. Z. Teshaev, D. A. Khasanova, Russian Journal of Operative Surgery and Clinical Anatomy **3(2)**, 19–24 (2019)

23. S. Z. Teshaev, D. A. Khasanova, Russian Journal of Operative Surgery and Clinical Anatomy **4(1)**, 41–45 (2020)

24. Sh. Zh. Teshaev, R. R. Baimuradov, Russian Journal of Operative Surgery and Clinical Anatomy **4(2)**, 22–26 (2020)

25. S. J. Teshayev, D. K. Khudoyberdiyev, S. S. Davlatov, International Journal of Pharmaceutical Research **13(1)**, 679-682 (2021)

26. S. J. Teshayev, D. K. Khudoyberdiyev, S. S. Davlatov, International Journal of Pharmaceutical Research **13(1)**, 679-682 (2021)

27. S. V. Yanchenko, A. V. Malyshev, S. Zh. Teshaev, L. M. Petrosyan, S. Sh. Ramazonova, Oftalmologiya **20(4)**, 772–779 (2023)

28. S. V. Yanchenko, A. V. Malyshev, Sh. Zh. Teshaev, R. R. Boboeva, G. B. Juraeva, Oftalmologiya **20(4)**, 780–786 (2023)

29. S. Yu, R. Liu, G. Zhao et al., The Journal of Head and Face Pain **52(4)**, 582-91 (2012)

30. A. F. Zayniyev, Z. B. Kurbaniyazov, S. S. Davlatov, K. E. Rakhmanov, Annals of the Romanian Society for Cell Biology **25(4)**, 1962-1969 (2021)