Acta Medica Mediterranea, 2022, 38: 3353

ANALYSIS OF NURSING INTERVENTION AND THE CHANGES IN LEUKOCYTE AND BLOOD GLUCOSE IN PATIENTS WITH ACUTE CRANIOCEREBRAL TRAUMA

Junyi Yang*
Department of Nursing, The Second Affiliated Hospital of Shenyang Medical College, Shenyang 110035, Liaoning Province, China

ABSTRACT

Introduction*: Acute brain injury (ABI) causes a series of biochemical and physiological changes in the brain and systemic circulation. This study aimed to investigate the changes in leukocytes and blood glucose and the prognostic effect of targeted nursing intervention in patients with ABI.*

Materials and methods*: Eighty ABI patients diagnosed in the Second Affiliated Hospital of Shenyang Medical College were randomly divided into an observation group (n=40) and a control group (n=40), and changes in white blood cells (WBCs) and blood glucose were observed. The patients in the control group used routine nursing, while those in the observation group used hypoglycemic targeted nursing. After 1 month of nursing intervention and 3 ~ 6 months of follow-up, the prognoses of the two groups were compared.*

Results*: According to the Glasgow coma scale (GCS) score at admission, there were 21 patients in group I (3-5 points), 19 patients in group II (6-8 points), 15 patients in group III (9-12 points), and 25 patients in group IV (13-15 points). Leukocyte and blood glucose levels gradually increased, peaking on day 8. The observation group was better than the control group in terms of blood glucose recovery time, hospital stay time, motor function, and mortality (P<0.05). There were considerable differences in prognosis, recovery, plant survival, and death between the two groups (P<0.05).*

Conclusion*: The changes in WBC count and blood glucose in ABI patients can be used as important indicators to judge the prognosis of patients. Targeted nursing intervention for ABI patients can help to control blood glucose levels, shorten discharge times, improve cure rates, and reduce mortality.*

Keywords: *acute brain injury, white blood cells, blood sugar, nursing, Glasgow.*

DOI: 10.19193/0393-6384_2022_5_495

Received *January 15, 2022;* ***Accepted*** *June 20, 2022*

Introduction

PAcute brain injury (ABI) is one of the most common clinical emergencies in neurosurgery, as well as one of the diseases with high mortality and disability rates(1-3). Its mortality and morbidity are high and mainly include craniocerebral injury and hemorrhage, subarachnoid hemorrhage, and ischemic stroke. Survivors often have neurological dysfunction. After the occurrence of ABI, the body enters a state of high catabolism, energy consumption increases rapidly, and protein catabolism accelerates. In particular, patients in ABI coma with a Glasgow coma scale (GCS) of 8 are more prone to serious metabolic disorders(4-6). Currently, researchers have made great progress in the treatment of patients with brain trauma, which can improve the prognosis to some extent. However, ABI leads to a series of physiological and biochemical changes in the brain and systemic circulation that may lead to secondary damage to the nervous system and adversely affect the prognosis and repair of the nervous system.

Computerized tomography (CT) and magnetic resonance imaging (MRI) are increasingly developed, but they cannot meet the real needs in some special cases, such as earthquake relief or most primary hospitals, because the equipment is bulky and expensive(7-9).

As a quick and convenient detection method, the application value of routine blood examination in ABI should not be ignored. White blood cells are important blood cells that are generally spherical and classified into neutrophils, eosinophils, basophils, monocytes, and lymphocytes(10-12). They can engulf foreign bodies and produce the corresponding antibodies that can heal the body in case of injured and play an important role in resisting the invasion of pathogens and immunity against diseases(13).

This study aimed to investigate changes in leukocytes and blood glucose and the prognostic effect of targeted nursing intervention in patients with ABI.

Materials and methods

The research object

In this study, 80 ABI patients diagnosed in the Second Affiliated Hospital of Shenyang Medical College from October 15, 2019, to March 25, 2022, were selected as the study subjects. They were randomly divided into an observation group and a control group, with 40 cases in each group, to observe the changes in WBC and blood glucose. There was a GCS score > 8 in 53 patients and ≤ 8 in 27 patients at admission. There were 21 males and 19 females in the control group, ranging from 18 to 65 years old, with an average age of 43.82 ± 5.74 years old. In the control group, there were 13 cases of skull fracture, 20 cases of intracranial hematoma, 3 cases of concussion, and 4 cases of brain contusion. There were 23 males and 17 females in the observation group, ranging from 18 to 63 years old, with an average age of 41.89 ± 7.75 years old. In the observation group, there were 13 cases of skull fracture, 7 cases of subarachnoid hemorrhage, 3 cases of concussion, and 17 cases of cerebral contusion and laceration with intracranial hematoma. There was no difference in general data between the two groups (P>0.05). This experiment was approved by the committee of the Second Affiliated Hospital of Shenyang Medical College, and patients and their families understood the research situation and signed informed consent.

Inclusion criteria: i) all included patients met the criteria of the fourth national academic conference on cerebrovascular diseases (1995) (14); ii) patient's fasting blood glucose extracted after admission was > 7.8 mmol/L; iii) no drugs affecting blood glucose were used within seven days before admission.

Exclusion criteria: i) patients with a history of diabetes; ii) patients with heart, liver, and kidney insufficiency; iii) patients with tumors.

Nursing intervention methods

All patients underwent emergency treatment including hemostasis, dehydration, and anti-infection. Hematoma removal was required in patients with intracranial hematoma. Cross-matched blood, electrolytes, blood glucose, blood type, and routine blood samples were collected before the establishment of venous access after admission. At the same time, the patient's vital signs, consciousness, pupil, and GCS score were observed. Patients in the control group received routine nursing care including medication nursing and monitoring of vital sign. Patients in the observation group received targeted hypoglycemic nursing as follows:

I. Blood glucose monitoring: Hyperglycemia samples were collected daily from day 1 to day 4 and every other day from day 6 to day 14 after surgery. Fasting venous blood samples were collected from patients in the morning to measure blood glucose, and the insulin dose was adjusted appropriately according the results of blood glucose measurement. In this experiment, the principle of monitoring before medication was followed.

II. Insulin treatment: For patients with blood glucose concentrations ≥ 14 mmol/L, 50 U insulin was diluted with 500 mL normal saline, and the infusion rate was set to 1 drop/min. Peripheral blood glucose was monitored every 3 h, and the insulin dose was adjusted over time. For patients with blood glucose concentrations < 14 mmol/L, 1 U insulin was diluted with 10% glucose, and the input rate was set at 1-2 U/h. When the blood glucose dropped to 3.3~4.3 mmol/L, the dose of insulin was reduced over time.

III. Dietary care: The patient was given liquid food early after surgery, intravenous rehydration, and a slow infusion of sodium electrolyte fluid. After anal exhaust, they gradually return to a normal diet, eat more high-protein and low-cholesterol food, and eat as little as possible.

IV. Functional exercise: After the blood glucose was restored to normal levels, functional exercise was carried out according to the patient's recovery to promote the patient's functional recovery and control blood glucose. If the intracranial pressure was kept below 270 mm H_2O, passive and active limb movement was performed on the bed. The medical staff assisted the patient in stretching or rotating the limb joints with sitting-up training.

V. Health guidance: The medical staff taught the patients and their families about the prevention and control methods of hyperglycemia so that the patients could learn to self-monitor their blood glucose levels and symptoms of hyperglycemia and come to the hospital in time if they felt uncomfortable. In daily life, patients learn to combine work and rest, adhere to a light, low salt, and low cholesterol diet, and carry out appropriate exercise to prevent high blood sugar.

Observation indicators

Blood WBC count, blood glucose, and nursing effects were observed in two groups. Evaluation of nursing effect included blood glucose recovery time (d), length of hospital stay (d), and motor function and fatality rate (%). GCS scoring method was used to evaluate motor function. The higher the total score, the better the motor function. The absolute value of peripheral CD34+ lymphocytes (/μL) was determined by flow cytometry using the ProC OUNT kit and Tro COUNT tube. After one month of nursing intervention, the patients were followed up for three to six months, and the prognosis of each group was compared. The curative effect results were cure, improvement, plant survival, and death.

Statistical methods

SPSS 21.0 statistical software was used for the statistical analysis of the data. The calculated data conforming to the normal distribution were expressed as the mean ± standard deviation (x ± s), and those conforming to the normal distribution were expressed as a percentage (%). The Pearson Chi-square test was used for the test of counting data and pial comparison between groups according to the data characteristics. In addition, $P<0.05$ indicated a significant difference.

Results

Changes in WBC count and blood glucose in peripheral blood

According to the GCS score at admission, there were 21 patients in group I (3-5 points), 19 patients in group II (6-8 points), 15 patients in group III (9-12 points), and 25 patients in group IV (13-15 points). The changes in peripheral blood WBC counts and blood glucose on days 1, 2, 3, 4, 6, 8, 10, 12, and 14 after ABI are shown in Tables 1 and 2, respectively. The WBC and blood glucose levels in each group increased gradually after injury and peaked on the 8th day.

	Day 1	Day 2	Day 3	Day 4	Day 6
Group I	17.83 ± 7.78	18.46 ± 7.82	19.72 ± 7.37	21.85 ± 6.89	22.63 ± 7.89
Group II	13.52 ± 4.83	14.78 ± 4.73	16.72 ± 3.89	17.56 ± 4.83	18.73 ± 3.83
Group III	7.46 ± 2.72	8.92 ± 2.71	9.45 ± 2.67	10.53 ± 2.52	14.63 ± 2.82
Group IV	5.78 ± 1.26	7.78 ± 1.72	8.72 ± 1.82	9.25 ± 1.72	10.52 ± 1.92
	Day 8	Day 10	Day 12	Day 14	
Group I	24.89 ± 8.83	23.89 ± 7.67	22.45 ± 7.27	19.65 ± 7.46	
Group II	21.34 ± 4.17	20.71 ± 4.26	19.67 ± 3.71	19.32 ± 3.28	
Group III	17.27 ± 2.67	17.12 ± 2.78	16.78 ± 2.17	16.23 ± 2.98	
Group IV	13.82 ± 1.52	13.26 ± 1.26	12.89 ± 1.89	12.27 ± 1.25	

Table 1: Comparison of peripheral blood WBC counts in each group ($\times 10^9$/L, $\bar{x}$±s).

	Day 1	Day 2	Day 3	Day 4	Day 6
Group I	7.12 ± 1.22	7.68 ± 1.72	8.45 ± 1.32	8.92 ± 1.82	9.63 ± 1.45
Group II	5.92 ± 1.02	6.65 ± 1.06	6.89 ± 1.21	7.12 ± 1.25	7.35 ± 1.72
Group III	5.23 ± 1.05	5.78 ± 1.04	5.89 ± 1.06	6.24 ± 1.78	6.45 ± 1.62
Group IV	4.26 ± 1.04	4.34 ± 1.06	4.57 ± 1.03	4.87 ± 1.08	5.22 ± 1.62
	Day 8	Day 10	Day 12	Day 14	
Group I	24.89 ± 8.83	23.89 ± 7.67	22.45 ± 7.27	19.65 ± 7.46	
Group II	10.31 ± 3.28	10.23 ± 3.26	9.87 ± 2.17	9.63 ± 2.71	
Group III	7.67 ± 1.67	7.44 ± 1.62	6.74 ± 1.78	6.31 ± 1.62	
Group IV	6.62 ± 1.65	6.46 ± 1.82	6.21 ± 1.72	5.28 ± 1.62	

Table 2: Comparison of blood glucose in each group (mmol/L, $\bar{x}$±s).

Changes in the number of CD34+ cells

The changes in CD34+ cell numbers on days 1, 2, 3, 4, 6, 8, 10, 12, and 14 after injury are shown in Figure 1. The number of CD34+ cells in the peripheral blood of group I increased rapidly after injury and peaked on day 8, while that of group IV increased slightly and peaked on day 12 and decreased on day 14.

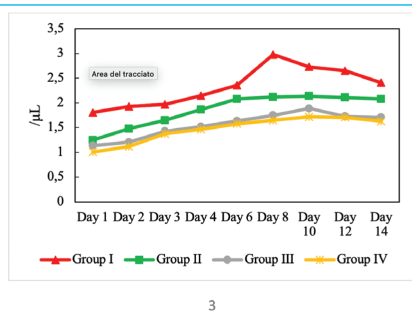

Figure 1: Comparison of CD34+ cell counts in the peripheral blood of each group.

Effect of nursing intervention

Comparison of the nursing intervention effect between the two groups in Table 3 shows that blood glucose recovery time, hospital stay time, motor function, and mortality in the observation group were better than those in the control group, and the difference was statistically considerable (P<0.05).

	Control group (n=40)	Observation group (n=40)	χ^2	P
Blood glucose recovery time (d)	7.85 ± 2.81*	4.31 ± 1.24*	8.89	<0.05
Length of hospital stay (d)	18.52 ± 2.62*	11.72 ± 2.17*	10.28	<0.05
GCS Score (point)	6.84 ± 2.71*	9.83 ± 2.89*	4.25	<0.05
Case fatality rate (n, %)	7(17.5%)*	3(7.5%)*	4.73	<0.05

Table 3: Comparison of the nursing intervention effect between the two groups.

Results of follow-up

In the control group, 8 cases (20.0%) were cured, 11 cases (27.5%) improved, 14 cases (35.0%) vegetatively died, and 7 cases (17.5%) died. In the experimental group, 16 patients (40.0%) were cured, 13 patients (32.5%) improved, 8 patients (20.0%) vegetatively died, and 3 patients (7.5%) died. There were statistically considerable differences in prognosis, recovery, plant survival, and death between the two groups (P<0.05) (Figure 2).

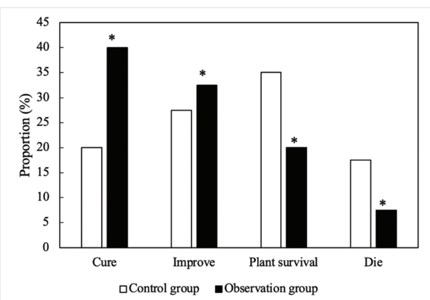

Figure 2: Comparison of follow-up results.
*Note: *represents a statistically considerable difference compared with the control group, P<0.05.*

Discussion

Blood glucose elevation after ABI is a stress response of the body. When hypothalamus injury occurs, the stress response will cause the sympathetico-adrenullary system to be overexcited, and the level of catecholamine in blood will increase. This stimulates glucagon release and liver glycogen decomposition[15-17]. In addition, the secretion of hypoglycemic hormones such as thyroxine and growth hormone increased, insulin secretion was inhibited, affinity decreased, and blood glucose increased rapidly. Because of the pathophysiological characteristics mentioned above, targeted nursing intervention requires careful dynamic observation and recording of patients' consciousness, pupils, and vital signs. Suitable nursing should be given to care for the respiratory tract, digestive tract, and traumatic epilepsy. All kinds of catheters should be placed, and prevention of various complications of nursing measures and the dynamic monitoring of blood glucose should be implemented.

Once abnormal blood glucose is found, corresponding nursing intervention measures should be formulated in time.

ABI often leads to an increase in WBC count and blood glucose[18]. The cause of elevation may be related to the degree of craniocerebral injury and the prognosis of patients[19,20]. The results of this study showed that the more severe ABI was, the higher blood WBC and blood glucose levels were. In ABI patients with GCS scores of 3-5 and 6-8, the WBC count and blood glucose peaks were more than 21.00×10^9/L and 8 mmol/L, respectively. The follow-up results of this study showed that the WBC count and blood glucose values in patients with a GCS score of 3 to 5 points were remarkably higher than those in other groups, with statistically considerable differences (P<0.05). The WBC count and blood glucose can be used as important indicators to evaluate the prognosis of ABI patients. This is consistent with the research results of Oh et al. (2019[21]).

Hypoglycemic nursing intervention is an intervention specifically for ABI patients with elevated blood glucose. When ABI patients are admitted to the hospital, continuous monitoring of blood glucose levels can obtain the most accurate blood glucose value to carry out symptomatic treatment. Insulin is commonly used to lower blood glucose, but the hyperglycemic response caused by ABI is not exactly the same as that of diabetic patients. Therefore, blood glucose levels should be closely monitored during insulin injection, and appropriate doses should be given according to the patient's conditions[22-24].

n this study, insulin injection was based on the principle of detection before medication to ensure that drugs were fully effective. In addition, ABI patients can experience fibrous adhesions in and around joints due to blocked joint activity, poor venous lymphatic return, serous cellulose oozing, and fibrin precipitation in tissue gaps. Contracture is caused by the immobility of muscles, joint capsules, and tendons, which eventually leads to stiffness and deformity of the joint. In this study, early rehabilitation training improved the circulation of blood and lymph through muscle movement to improve the metabolic rate. At the same time, it can also promote the relevant nerve cell axis bud, resulting in the creation of new synapses. Then, through repetitive training, these synapses can re-establish the neural circuit network - synaptic chain with similar normal function, to realize the recombination of central nervous function, inhibit the low central motor abnormalities, and make the synaptic chain in the suppressed multi-threshold state, thus improving limb function. Wu et al. (2021)[25] reported that early rehabilitation training was remarkably superior to drug therapy alone and functional exercise during recovery in promoting functional recovery of the affected limb and improving the ability of daily living. Early appropriate rehabilitation nursing can greatly reduce the incidence of muscle atrophy, foot ptosis, and joint contracture deformity and dislocation to achieve comprehensive rehabilitation. A comparison of the nursing intervention effect between the two groups showed that blood glucose recovery time, hospital stay time, motor function, and mortality in the observation group were better than those in the control group, and the difference was statistically considerable ($P<0.05$). This was consistent with the research results of previous reports[26-28].

Blood glucose concentrations are usually in the range of 90-80 mg dl every morning in a fasting person[29-34]. This concentration rises to 140-120 mg/dl in the first hour or so after a meal[35]. But feedback systems to control blood glucose return glucose levels to normal quickly (usually within 2 hours of the last carbohydrate absorption)[36-37]. Conversely, in the state of malnutrition, gluconeogenesis in the liver provides the glucose needed to maintain fasting glucose concentrations. These values are slightly higher for diabetics[38-39].

It was suggested that careful and comprehensive health education can effectively promote communication between medical staff and patients and their families, make patients and their families better cooperate in treatment, improve compliance, promote the nurse-patient relationship, build a harmonious hospital environment, and improve the quality of medical care.

Conclusion

In this study, 80 patients with ABI were monitored dynamically, and insulin was used in a timely manner according to their blood glucose levels to effectively control blood glucose. At the same time, nutritional support therapy, coupled with appropriate functional exercise and health education, was given, aiming to achieve a good prognosis through targeted nursing interventions. The changes in WBC count and blood glucose in ABI patients can be used as important indicators to judge the prognosis of patients. Targeted nursing intervention for ABI patients was beneficial to control blood glucose levels, shorten hospitalization times, improve cure rates, and reduce mortality. The limitation of this study is the limitation of the conditions selected for the included patients. Due to the sudden onset of ABI, many patients have aspiration pneumonia or other lesions. Therefore, the sample collection cycle is longer, and fewer cases are needed for further improvement. In conclusion, this study provides some references for the nursing intervention of ABI.

References

1) Robba C, Graziano F, Rebora P, Elli F, Giussani C, Oddo M, Meyfroidt G, Helbok R, Taccone FS, Prisco L, Vincent JL, Suarez JI, Stocchetti N, Citerio G. Intracranial pressure monitoring in patients with acute brain injury in the intensive care unit (SYNAPSE-ICU): an international, prospective observational cohort study. Lancet Neurol 202; 20: 548-558. doi: 10.1016/S1474-4422(21)00138-1.

2) Gao P, Tang S, Chen H, Zhou X, Ou Y, Shen R, He Y. Preconditioning increases brain resistance against acute brain injury via neuroinflammation modulation. Exp Neurol 2021; 341: 113712. doi: 10.1016/j.expneurol.2021.113712.

3) Lawati KA, Sharif S, Maqbali SA, Rimawi HA, Petrosoniak A, Belley-Cote EP, Sharma SV, Morgenstern J, Fernando SM, Owen JJ, Zeller M, Quinlan D, Alhazzani W, Rochwerg B. Efficacy and safety of tranexamic acid in acute traumatic brain injury: a systematic review and meta-analysis of randomized-controlled trials. Intensive Care Med 2021; 47: 14-27. doi: 10.1007/s00134-020-06279-w.

4) Chen H, Song Z, Dennis JA. Hypertonic saline versus other intracranial pressure-lowering agents for people with acute traumatic brain injury. Cochrane Database Syst Rev 2020;1:CD010904. doi: 10.1002/14651858.CD010904.pub3.

5) Huang M, Gedansky A, Hassett CE, Price C, Fan TH, Stephens RS, Nyquist P, Uchino K, Cho SM. Pathophysiology of Brain Injury and Neurological Outcome in Acute Respiratory Distress Syndrome: A Scoping Review of Preclinical to Clinical Studies. Neurocrit Care 2021; 35: 518-527. doi: 10.1007/s12028-021-01309-x.

6) Wilcox C, Etchill E, Giuliano K, Mayasi Y, Gusdon AM, Cho I CW, Kim BS, Bush EL, Geocadin RG, Whitman GJ, Cho SM. Acute Brain Injury in Postcardiotomy Shock Treated With Venoarterial Extracorporeal Membrane Oxygenation. J Cardiothorac Vasc Anesth 2021; 35: 1989-1996. doi: 10.1053/j.jvca.2021.01.037.

7) Shi SX, Shi K, Liu Q. Brain injury instructs bone marrow cellular lineage destination to reduce neuroinflammation. Sci Transl Med 2021; 13: eabc7029. doi: 10.1126/scitranslmed.abc7029.
8) Zink F, Vogt J, Wachter U, Hartert J, Horchler M, Zhang X, Hezel F, Kapapa T, Datzmann T, Hoffmann A, Wepler M, Calzia E, Radermacher P, Hartmann C. Effects of Acute Subdural Hematoma-Induced Brain Injury On Energy Metabolism in Peripheral Blood Mononuclear Cells. Shock 2021; 55: 407-417. doi: 10.1097/SHK.0000000000001642.
9) Zhou Q, Niño DF, Yamaguchi Y, Wang S, Fulton WB, Jia H, Lu P, Prindle T Jr, Pamies D, Morris M, Chen LL, Sodhi CP, Hackam DJ. Necrotizing enterocolitis induces T lymphocyte-mediated injury in the developing mammalian brain. Sci Transl Med 2021; 13: eaay6621. doi: 10.1126/scitranslmed.aay6621.
10) Otxoa-de-Amezaga A, Miró-Mur F, Pedragosa J, Gallizioli M, Justicia C, Gaja-Capdevila N, Ruíz-Jaen F, Salas-Perdomo A, Bosch A, Calvo M, Márquez-Kisinousky L, Denes A, Gunzer M, Planas AM. Microglial cell loss after ischemic stroke favors brain neutrophil accumulation. Acta Neuropathol 2019;137:321-341. doi: 10.1007/s00401-018-1954-4.
11) Zhang CN, Li FJ, Zhao ZL, Zhang JN. The role of extracellular vesicles in traumatic brain injury-induced acute lung injury. Am J Physiol Lung Cell Mol Physiol 2021; 321: L885-L891. doi: 10.1152/ajplung.00023.2021.
12) Cahilog Z, Zhao H, Wu L, Alam A, Eguchi S, Weng H, Ma D. The Role of Neutrophil NETosis in Organ Injury: Novel Inflammatory Cell Death Mechanisms. Inflammation 2020; 43: 2021-2032. doi: 10.1007/s10753-020-01294-x.
13) Aertker BM, Kumar A, Prabhakara KS, Smith P, Furman NET, Hasen X, Cox CS, Bedi SS. Pre-injury monocyte/macrophage depletion results in increased blood-brain barrier permeability after traumatic brain injury. J Neurosci Res 2019; 97: 698-707. doi: 10.1002/jnr.24395.
14) Sachdev PS, Lipnicki DM, Crawford JD, Brodaty H. The Vascular Behavioral and Cognitive Disorders criteria for vascular cognitive disorders: a validation study. Eur J Neurol 2019; 26: 1161-1167. doi: 10.1111/ene.13960.
15) Aydın GA, Özgen G, Görükmez O. The role of genetic mutations in intrahepatic cholestasis of pregnancy. Taiwan J Obstet Gynecol 2020; 59: 706-710. doi: 10.1016/j.tjog.2020.07.014.
16) Vitale G, Gitto S, Vukotic R, Raimondi F, Andreone P. Familial intrahepatic cholestasis: New and wide perspectives. Dig Liver Dis 2019; 51: 922-933. doi: 10.1016/j.dld.2019.04.013.
17) Tam EWY, Kamino D, Shatil AS, Chau V, Moore AM, Brant R, Widjaja E. Hyperglycemia associated with acute brain injury in neonatal encephalopathy. Neuroimage Clin 2021; 32: 102835. doi: 10.1016/j.nicl.2021.102835.
18) Carteron L, Solari D, Patet C, Quintard H, Miroz JP, Bloch J, Daniel RT, Hirt L, Eckert P, Magistretti PJ, Oddo M. Hypertonic Lactate to Improve Cerebral Perfusion and Glucose Availability After Acute Brain Injury. Crit Care Med 2018; 46: 1649-1655. doi: 10.1097/CCM.0000000000003274.
19) Gul HF, Dolanbay T, Simsek AT, Aras M. Evaluation of Blood Urea, Creatinine, and Glucose Levels as Biochemical Indicators of the Type and Severity of Traumatic Brain Injury. Turk Neurosurg 2021; 31: 333-338. doi: 10.5137/1019-5149.JTN.29843-20.2.
20) Yang X, Zhang Y, Geng K, Yang K, Shao J, Xia W. Sirt3 Protects Against Ischemic Stroke Injury by Regulating HIF-1α/VEGF Signaling and Blood-Brain Barrier Integrity. Cell Mol Neurobiol 2021; 41: 1203-1215. doi: 10.1007/s10571-020-00889-0.
21) Oh H, Lee K, Shin S, Seo W. Temporal Patterns and Influential Factors of Blood Glucose Levels During the First 10-Day Critical Period After Brain Injury. Clin Nurs Res 2019; 28: 744-761. doi: 10.1177/1054773817749725.
22) Chapple LA, Chapman M, Shalit N, Udy A, Deane A, Williams L. Barriers to Nutrition Intervention for Patients With a Traumatic Brain Injury: Views and Attitudes of Medical and Nursing Practitioners in the Acute Care Setting. JPEN J Parenter Enteral Nutr 2018; 42: 318-326. doi: 10.1177/0148607116687498.
23) Rahayu UB, Wibowo S, Setyopranoto I, Hibatullah Romli M. Effectiveness of physiotherapy interventions in brain plasticity, balance and functional ability in stroke survivors: A randomized controlled trial. NeuroRehabilitation 2020; 47: 463-470. doi: 10.3233/NRE-203210.
24) Larsen LK, Møller K, Petersen M, Egerod I. Delirium prevalence and prevention in patients with acute brain injury: A prospective before-and-after intervention study. Intensive Crit Care Nurs 2020;59:102816. doi: 10.1016/j.iccn.2020.102816.
25) Wu H, Gong L, Qian Z, Mao Q. Analysis of the influencing factors and nursing strategy for acute atelectasis after traumatic brain injury surgery. Ann Palliat Med 2021; 10: 5425-5432. doi: 10.21037/apm-21-790.
26) Oyesanya TO, Bowers BJ, Royer HR, Turkstra LS. Nurses' concerns about caring for patients with acute and chronic traumatic brain injury. J Clin Nurs 2018; 27: 1408-1419. doi: 10.1111/jocn.14298.
27) vInandiklioglu N, Demir V, Celik Y, Demirtas M. Leukocyte telomere length and lipid parameters in patients with myocardial infarction with non-obstructive coronary arteries. Cell Mol Biol 2022; 67: 346-352. doi: 10.14715/cmb/2021.67.6.45.
28) Ghazizadeh H, Kathryn Bohn M, Kardagh Polus R, Abdulkarimi R, Mahdavizadeh V, et al. Comprehensive hematological reference intervals in a healthy adult male population. Cell Mol Biol 2020; 66: 99-104. doi: 10.14715/cmb/2020.66.2.16.
29) Wei M, Feng L, Zhao W.. Efficacy of low-dose insulin combined with electrolyte in the treatment of pediatric diabetic ketoacidosis and its effect on serum inflammatory factors. Cell Mol Biol 2020; 66: 98-104. doi: 10.14715/cmb/2020.66.5.18.
30) Sun Y, Yu Q, Xie J. Investigating the changes in the levels of HbA1c, blood fat and insulin sensitivity in elder patients with type II diabetes mellitus due to combined medication of pioglitazone and melbine and single-use of pioglitazone. Cell Mol Biol 2020; 66: 21-28. doi: 10.14715/cmb/2020.66.6.5.
31) Parveen K, Siddiqui WA, Arif JM, Kuddus M, Shahid SMA, Kausar MA. Evaluation of vegetables and fish oils for the attenuation of diabetes complications. Cell Mol Biol 2019; 65: 38-45. doi : 10.14715/cmb/2019.65.7.8.
32) Qian K, Dong H, Qian J, Gong J. Effect of glycosylated hemoglobin protein molecule in treating diabetes. Cell Mol Biol 2020; 66: 45-48. doi:10.14715/

cmb/2020.66.5.9.
33) Wang Q, Wang C. Comparison of the expression levels of TNF-Î±, IL-6, hsCRP and sICAM-1 inflammatory factors, bone mineral density and nutritional status between diabetic and normal pregnant women. Cell Mol Biol 2020; 66: 132-137.doi: 10.14715/cmb/2020.66.3.20.
34) Zhu R, Du T, Gao H. Effects of dezocine and ropivacaine infiltration anesthesia on cellular immune function indicators, anesthesia recovery time and pain factors in patients with open liver resection. Cell Mol Biol 2020; 66: 149-154. doi:10.14715/cmb/2020.66.3.23.
35) Wang L, Huang L, Li N, Miao J, Liu W, Yu J. Ameliorative effect of polydatin on hyperglycemia and renal injury in streptozotocin-induced diabetic rats. Cell Mol Biol 2019; 65: 55-59. doi:10.14715/cmb/2019.65.7.10.
36) Sawicka B, Skiba D, Pszczó Å, Kowski P, Aslan I, et al. Jerusalem artichoke (Helianthus tuberosus L.) as a medicinal plant and its natural products. Cell Mol Biol 2020; 66: 160-177. doi:10.14715/cmb/2020.66.4.20.
37) Maulood KA. Estimation of vitamin D receptor gene polymorphism in Type 2 Diabetes Mellitus patients in Erbil city. Cell Mol Biol 2021; 67: 76-84. doi:10.14715/cmb/2021.67.3.10.
38) Li J, Li X, Qiao X. Analysis of circRNA regulatory network in myocardial tissue of type 1 diabetic mice. Cell Mol Biol 2021; 67: 201-203. doi:10.14715/cmb/2021.67.3.32.
39) Zheng Y, Shi H, Zhou Y, Wang A, Kang D, Kang L. Effects of endoplasmic reticulum stress, liver function, insulin resistance and vascular endothelial function in patients with nonalcoholic fatty liver disease. Cell Mol Biol 2022; 67: 210-217. doi:10.14715/cmb/2021.67.5.29.

Corresponding Author:
Junyi Yang
Email: yangjunyi2022@yandex.com
(China)