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Interventional therapy of diabetes mellitus type 2 complicated with acute cerebral hemorrhage by using dexmedetomidine

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ABSTRACT

Objective: To study the effects of dexmedetomidine on cerebral injury, inflammation, oxidative stress and renal function of patients with diabetes mellitus type 2 complicated with acute cerebral hemorrhage.

Methods: A total of 98 cases who had been diagnosed with diabetes mellitus type 2 complicated with acute cerebral hemorrhage and treated with interventional therapy in Xin Hua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from September 2014 January 2016 were chosen to be our study subjects. Among them, 50 cases given dexmedetomidine treatment in the process of anesthesia were included in the dexmedetomidine group (Group A), while the other 48 cases treated with equal amount of normal saline were considered as the negative control group. The postoperative cerebral injury indexes and the serum biochemical indexes were detected after 24 h.

Results: The contents of serum S100β [(2.1 ± 0.2) μg/L] and neuron-specific enolase (NSE) [(14.2 ± 1.3) μg/mL] in Group A were all significantly lower than serum S100β [(2.9 ± 0.3) μg/L] and NSE [(16.6 ± 1.7) μg/mL] of patients in negative control group. The contents of cerebrospinal fluid S100β [(0.9 ± 0.1) μg/L] and NSE [(10.7 ± 1.3) μg/mL] in Group A were all significantly lower than cerebrospinal fluid S100β [(1.3 ± 0.2) μg/L] and NSE [(15.3 ± 1.7) μg/mL] of patients in negative control group. The contents of erythrocyte sedimentation rate [(11.7 ± 2.5) mm/h], c-reactive protein [(2.3 ± 0.4) mg/L], urea nitrogen [(10.7 ± 1.2) mmol/L] and serum creatinine [(151.6 ± 14.9)] μmol/L in Group A were all significantly lower than erythrocyte sedimentation rate [(23.6 ± 3.8) mm/h], c-reactive protein [(6.9 ± 1.1) mg/L], urea nitrogen [(16.7 ± 1.7) mmol/L] and serum creatinine [(192.5 ± 18.3)] μmol/L of patients in negative control group.

Conclusions: The application of dexmedetomidine in the interventional therapy of diabetes mellitus type 2 complicated with acute cerebral hemorrhage could protect brain and renal functions and reduce systemic inflammatory responses.

1. Introduction

Diabetes is a kind of common metabolic disorders characterized by a systemically chronic progressive increase of blood sugar level. Due to its long disease course, it can easily lead to metabolic disorders and affect systems of heart, renal, eye, nerve and so on. Cerebrovascular disease is one of the common complications of diabetes with an incidence rate of 20%–40%. The basic pathological of the disease is atherosclerosis[1–3]. In recent years, people have paid more and more attentions to the effect of dexmedetomidine on sedating, controlling the stress response and inhibiting the apoptosis of nerve cells in the perioperative period which has been used in the management and the protection of nerve function in the perioperative period of neurosurgical operation[4,5]. This study aimed to discuss the application and value of dexmedetomidine in patients with diabetes mellitus type 2 complicated with acute cerebral hemorrhage during the perioperative period.

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The study protocol was performed according to the Helsinki declaration and approved the Ethics Committee of Xin Hua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine. Informed written consent was obtained from the selected patients and their families.

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#These authors contributed equally to this work.

2. Materials and methods

2.1. Clinical data

A total of 98 patients who had been diagnosed with diabetes mellitus type 2 complicated with acute cerebral hemorrhage, given interventional therapy in Xin Hua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine from September 2014 to January 2016 and met the following inclusion criteria were selected to be the study subjects. The inclusion criteria required that the chosen patients should show the first-ever cerebral hemorrhage, have a history of diabetes and be treated with surgical intervention, while patients with severe hepatic and renal dysfunction, history of mental illnesses and long-term application of opioid drugs would be excluded. This study was confirmed and approved by the Ethics Committee of our hospital and consents from the selected patients and their families were obtained.

The endpoint of all the selected patients was conducted for 1 week after surgery. Patients given dexmedetomidine treatment in the process of anesthesia were included in the dexmedetomidine group (Group A), while patients treated with equal amount of normal saline were included in the negative control group (NC group).

2.2. Experimental methods

According to the process that whether patients were treated with dexmedetomidine during surgery or not, those 98 patients were divided into two groups. Patients given dexmedetomidine were regarded as Group A (n = 50), while patients without dexmedetomidine were considered as NC group (n = 48). All selected patients received routine anesthetic induction (midazolam, propofol, atracurium, etomidate, fentanyl); laryngeal masks were placed to manage their airways and 1%–2% sevoflurane was used to maintain anesthesia in the operation. At 5 min before the operation, dexmedetomidine (0.5 μg/kg/h) was infused intravenously in patients in Group A, which would stop at 20 min before the surgery was finished. Patients in NC group were given equal amount of normal saline by the same way. On 24 h after surgery, 5 mL peripheral venous blood and 2 mL cerebrospinal fluid samples of patients in the two groups were collected. Chemiluminescence immunoassay was used to test the contents of S100β and neuron-specific enolase (NSE). ELISA was used to determine the c-reactive protein (CRP) content; Westergren method was applied to examine erythrocyte sedimentation rate (ESR); fully automatic biochemistry analyzer was employed to detect blood urea nitrogen (BUN), serum creatinine (Cr), aspartate aminotransferase (AST) and alanine aminotransferase (ALT); and myocardial enzyme spectrum detection was used to detect the contents of creatine kinase (CK) and CK-MB.

2.3. Statistical methods

The experimental data were typed and analyzed by SPSS 20.0.0. Measurement data were expressed by mean ± SD and analyzed by t-test and enumeration data were presented by frequency and analyzed by *Chi*-square test. Differences were statistically significant (P < 0.05).

3. Results

3.1. General data of the study subjects

Among those 98 cases, 50 of them were treated with dexmedetomidine. They were included in Group A. In Group A, 29 cases were males and 21 were females aging from (51 ± 6) years with a body mass index (BMI) of (24.2 ± 2.8) kg/m^2, preoperative blood glucose of 8–15 mmol/L [the average was (11.2 ± 0.8) mmol/L], disease courses of diabetes of 8–15 years [the average was (11.7 ± 1.5) years] and Glasgow coma scale (GCS) of 5–9 scores [the average was (6.8 ± 0.7) scores]. The other 48 cases were not treated with dexmedetomidine in the process of anesthesia. They were included in NC group. In NC group, 27 cases were males and 21 were females aging from (53 ± 5) years with a BMI of (24.6 ± 2.5) kg/m^2, preoperative blood glucose of 9–16 mmol/L [the average was (11.9 ± 1.2) mmol/L], disease courses of diabetes of 7–13 years [the average was (10.9 ± 1.7) years], GCS of 6–9 scores [the average was (6.7 ± 0.6) scores]. After statistically analyzing, it was found that the levels of genders, ages, BMI, blood glucose, disease courses, and GCS of the two groups showed no differences (P > 0.05).

3.2. Brain injury indexes

The serum indexes S100β of brain injury [(2.1 ± 0.2) μg/L] and NSE [(14.2 ± 1.3) μg/mL] of patients in the Group A were all significantly lower than those [(2.9 ± 0.3) μg/L and (16.6 ± 1.7) μg/mL, respectively] of patients in the NC group. Moreover, their cerebrospinal fluid indexes S100β of brain injury [(0.9 ± 0.1) μg/L] and NSE [(10.7 ± 1.3) μg/mL] of patients in the Group A were also distinctly lower than those [(1.3 ± 0.2) μg/L and (15.3 ± 1.7) μg/mL, respectively] in NC group (P < 0.05).

3.3. Serum biochemical index

On 24 h after surgery, ESR [(11.7 ± 2.5) mm/h], CRP [(2.3 ± 0.4) mg/L], BUN [(10.7 ± 1.2) mmol/L] and Cr [(151.6 ± 14.9) μmoL] in patients of Group A were all significantly lower than those [(23.6 ± 3.8) mm/h, (6.9 ± 1.1) mg/L, (16.7 ± 1.7) mmol/L and (192.5 ± 18.3) μmol/L, respectively] in patients of NC group. The differences of AST, ALT, CK and CK-MB between two groups showed no statistical significance (Table 1).

Table 1

Postoperative renal function indexes of patients in Group A and NC group.

Parameters	Group A (n = 50)	NC group (n = 48)	P
ESR (mm/h)	11.7 ± 2.5	23.6 ± 3.8	< 0.05
CRP (mg/L)	2.3 ± 0.4	6.9 ± 1.1	< 0.05
BUN (mmol/L)	10.7 ± 2.1	16.7 ± 2.8	< 0.05
Cr (μmol/L)	151.6 ± 30.4	192.5 ± 29.3	< 0.05
AST (IU/L)	12.3 ± 2.3	11.8 ± 2.5	> 0.05
ALT (IU/L)	15.8 ± 3.1	14.3 ± 2.7	> 0.05
CK (mmol/L)	214.3 ± 35.8	231.8 ± 40.7	> 0.05
CK-MB (mmol/L)	11.2 ± 2.5	10.9 ± 2.1	> 0.05