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Therapeutic effect of superselective interventional chemotherapy-radiotherapy combined treatment on decreasing postoperative residual cell numbers in brain glioma.

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Abstract

Objective: To observe and analyse the therapeutic effect of superselective interventional chemotherapy-radiotherapy combined treatment on reducing in number or eliminating postoperative residual cells in brain glioma.

Methods: Fifty-two patients with brain glioma, which were advised to undergo tumor resection in our hospital from January 2014 to January 2016, were selected and divided into observation (n=28) and control groups (n=24) according to patient preference. The observation group was given superselective interventional chemotherapy-radiotherapy combined treatment, whereas the control group was managed with systematic radiotherapy-chemotherapy treatment. The respective therapeutic effects were then compared between the two groups.

Results: The therapeutic effects on the observation group were significantly superior to those on the control group (P<0.05); however, the incidences of adverse reactions were insignificantly different (P>0.05). The prognostic effects were significantly greater in the observation group than in the control group (P<0.05). The Karnofsky grades (71.78 ± 4.83) were significantly higher in the observation group than in the control group (59.93 ± 5.17) (P<0.05).

Conclusion: Superselective interventional chemotherapy-radiotherapy combined treatment can effectively reduce and eliminate postoperative residual cells and produce a favorable prognostic effect in patients with brain glioma.

Keywords: Brain glioma, Superselective interventional chemotherapy, Radiotherapy.

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Introduction

As a brain and spinal glial cell malignancy, brain glioma is the most common primary intracranial brain tumor and comprises about 46% of all intracranial tumors [1,2]. Its clinical treatment mostly centers on surgery; however, as a malignant tumor, brain glioma can grow through infiltration and thus impede complete tumor excision [3]. Postoperative recurrence rate is high, and the tumor cells become resistant to drugs. Among the treatments, chemotherapy is limited, whereas radiotherapy is of great significance. The common chemotherapeutic treatment for brain glioma patients is mainly administered intravenously or orally. However, intravenous and oral drug doses are usually large but with low local drug concentrations in the tumor [4]. As a result, patients easily suffer from severe liver damage and bone marrow depression. Thus, chemotherapy is eventually terminated because of severe adverse reactions [5]. Superselective interventional chemotherapy-radiotherapy combined treatment was adopted after tumor resection to eliminate and reduce the amount of residual tumor cells after operation and prevent the recurrence of brain glioma.

General Information and Method

General information

Fifty-two patients of brain glioma advised for tumor resection in our hospital from January 2014 to January 2016 were selected for this study. After postoperative pathological examination, all patients were diagnosed with brain glioma based on existing standards. This research was approved by the Medical Ethics Committee in our hospital, and the patients signed informed consent forms. The participants were divided into observation (n=28) and control (n=24) groups according to patient preference. The observation group comprised 13 males and 15 females with ages ranging from 28 y to 67 y (mean: 41.78 ± 9.49 y). For tumor positions, 12 patients presented with tumors at the frontal lobes, 8 at the parietal lobes, 5 at the temporal lobes, 2 at the occipital lobes, and 1 at frontal-parietal lobes. The control group was composed of 11 males and 13 females with ages ranging from 29 y to 65 y (mean: 41.28 ± 9.43 y). For tumor positions, 9 patients harbored tumors at the frontal lobes, 6 at the parietal lobes, 4 at the temporal lobes, 3

at the occipital lobes, and 2 at the frontal-parietal lobes. General information, including gender, age, and tumor position, of the two groups showed insignificant differences (P>0.05).

Therapeutic method

The patients in the observation group were given superselective interventional chemotherapy-radiotherapy combined treatment. After operation, superselective interventional chemotherapy was administered using 1 mg/kg nimustine hydrochloride (Xi'an Haixin Pharmaceutical Co., Ltd; SFDA approval number H20003010; specification: 30 mg × 20 tablets) diluted in 50 ml of normal saline. Seidinger technology was employed to puncture into the right femoral artery of the patient, and a Magic1.8F Proeler10 microcatheter was placed and passed through until the ophthalmic artery. Before chemotherapy, 125 ml of 20% mannitol was diluted with 50 ml of 10% glucose saline. The diluted solution was then used to for intravenous titration at 15 ml/min to develop the blood-brain barrier. Nimoton (Bayer Medicine and Health Care Co., Ltd; SFDA approval number H20003010; specification: 30 mg × 20 tablets) was used in case of cerebral angiospasm. After 20 min, a micropump was employed to regulate the injection of the chemotherapeutics for 1 h once a week and one treatment course constituted four sessions. The two treatment courses were repeated after drug withdrawal for 6 w. A linear accelerator was used for whole-brain radiotherapy at a radiological dose of 60 Gy six times a week for 4-6 W. The radiologic dose each time was 3 Gy, and the target volume exceeded the tumor volume by 2 cm.

The patients in the control group were given systematic radiotherapy-chemotherapy combined treatment. After surgery, systematic chemotherapy was administered. Intravenous titration of nimustine hydrochloride (Xi'an Haixin Pharmaceutical Co., Ltd; SFDA approval number H20046672; specification: 25 mg) was conducted at 3 mg/kg, and the drug was re-administered 4 w after drug withdrawal. The continuous titration for three times constituted one treatment course. The radiotherapy offered to the control group was similar to that for the observation group, and follow-up visits lasted for 1 y.

Observational indexes

The therapeutic effects, adverse reactions, and prognostic states of the patients in the two groups were observed. Therapeutic effect was then divided into excellent, effective, micro-change, no change, and aggravated and was calculated as total therapeutic effect=(excellent+effective)/total number of cases × 100%. Karnofsky prognostic grading and evaluation were conducted and assessed as either life independent (ID), semi-independent (SD), and life dependent (DD). Low grades indicated poor patient prognoses.

Statistical analysis

The statistical software SPSS 22.0 was used for data analysis. The measured data were expressed as mean ± standard deviation ($\bar{x} \pm s$) under the t test, whereas the enumeration data were expressed as percentages through the χ^2 test. Differences at P<0.05 were considered statistically significant.

Results

Comparison between the two groups in the therapeutic effect

The therapeutic effects of patients in the observation group were significantly superior to those in the control group (P<0.05) (Table 1).

Table 1. Comparison of therapeutic effect between the two groups.

Group	Excellent	Effective	Micro-change	No change	Aggravated	Effective rate
Observation group (28)	8 (28.57%)	11 (39.29%)	5 (17.86%)	2 (7.14%)	2 (7.14%)	19 (67.86%)
Control group (24)	3 (12.5%)	5 (20.83%)	7 (29.17%)	6 (25%)	3 (12.5%)	8 (33.33%)
χ^2						16.098
P						0.000

Table 2. Comparison of the incidence of adverse reactions between the two groups.

Group	Infarction	Brain fever	Nausea	Hemogram change	Headache	Alopecia
Observation group (28)	1 (3.57%)	2 (7.14%)	20 (71.43%)	23 (82.14%)	4 (14.28%)	13 (46.43%)
Control group (24)	1 (4.17%)	3 (12.5%)	18 (75%)	21 (87.5%)	6 (25%)	14 (58.33%)
χ^2	0.048	1.622	0.325	1.116	3.641	2.839
P	0.826	0.203	0.569	0.291	0.056	0.092

Comparison of adverse reactions between the two groups

The difference in the incidence of adverse reactions (infarction, brain heat, nausea, hemogram change, headache, and fever) between the two groups was insignificant (P>0.05) (Table 2).

Comparison of prognosis effect between the two groups

The prognostic effects were significantly better in the observation group than in the control group (P<0.05). Moreover, the Karnofsky grades were significantly higher in the observation group (71.78 ± 4.83) than in the control group (59.93 ± 5.17) (Table 3).

Table 3. *Comparison of prognostic effect between the two groups.*

Group	ID	SD	DD	Karnofsky grade
Observation group (28)	16 (57.14%)	9 (32.14%)	3 (10.71%)	71.78 ± 4.83
Control group (24)	8 (33.33%)	7 (29.17%)	9 (37.5%)	59.93 ± 5.17
χ^2	13.442	0.325	15.781	8.538
P	0.000	0.564	0.000	0.000

Discussion

Brain tumors are mostly glioma, mainly astrocytoma and glioblastoma multiforme, whereas some are ganglionic glioma and ependymoma. Astrocytoma is chiefly located at the upper brainstem segment and is of low malignancy degree, whereas glioblastoma multiforme is primarily found at the lower brainstem segment. Fiber-type tumors are the most common [6]. In this brain tumor, neuroglial fibers are present and constitute the main difference from the magma type. The tumor texture is a firm, white, pervasive fiber-type tangent plane that is difficult to differentiate from alba. The adjacent cortex is usually infiltrated by tumor with deepened color and luster and obscures the boundary with the alba [7]. Cystic degeneration may also exist in the tumor center. The fiber-type boundary of the local lesion is smooth and flat and is mainly observed in the cerebellum with typical cystic degeneration. Under the microscope, neuroglial fibers appear cross distributed between tumor cells in the mesenchyme, and the tumor cells were fiber-type astrocytes. The magma type is the least common type, and its tangent plane presents a translucent uniform jelly shape with a deep portion invaded by alba. The tumor is characterized by an obscure boundary, usual degeneration, and cystic formation. Under the microscope, the tumor is composed of magma-type astrocytes [8,9].

Superselective interventional chemotherapy uses Seidinger technology to puncture into the patient's right femoral artery, Magic1.8F Proeler10 is then utilized to insert the microcatheter through the vessels until the ophthalmic artery and subsequently inject the chemotherapeutics [10]. This strategy can avoid defects, such as large chemotherapeutic dosage, low local drug delivery at the tumor, and severe adverse reactions and partially prevent the damage to ophthalmic and retinal arteries caused by antineoplastic drugs. With this technology, the blood-brain barrier is effectively developed, and the local drug concentration in the tumor is increased. The contact time between drug and tumor is prolonged, and additional antineoplastic drug enters the tumor cells. The therapeutic effects of superselective interventional chemotherapy-radiotherapy combined treatment on the postoperative inhibition of residual cells of brain glioma were observed and analysed, and the results were as follows. In summary, the therapeutic effects were significantly better in the observation group than in the control group (P<0.05), whereas the incidence of adverse reactions were comparable (P>0.05). These findings indicated that superselective interventional chemotherapy-radiotherapy combined treatment can effectively eliminate and inhibit the retention of postoperative tumor cells in brain glioma with significantly increased adverse reactants and safety. In addition, the prognostic effects in the observation group were significantly superior to those in the control group (P<0.05). The Karnofsky grades were also significantly higher in the observation group than in the control group (P<0.05). Hence, the superselective interventional chemotherapy-radiotherapy combined treatment effectively improved the prognosis and living quality of patients.

Conclusion

In summary, the superselective interventional chemotherapy-radiotherapy combined treatment successfully reduced and eliminated the postoperative residual cells in patients with brain glioma.

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