The effect observation of focus areas epidural hematoma removal combined with bone flap decompression in the treatment of severe contre-coup brain injury

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ABSTRACT

Objective: To observe effect observation of focus areas epidural hematoma removal combined with bilateral or unilateral bone flap decompression in the treatment of severe contre-coup brain injury (CCBI). Methods: From September 2011 to June 2015, 93 patients with severe CCBI were treated in our hospital. According to hematoma surgery program divided into A, B, C three groups. The group A was first given the patients with contralateral epidural hematoma, and immediately implement unilateral big bone flap decompression; group B underwent bilateral frontotemporal craniotomy hematoma removal and bilateral to bone flap decompression, and immediately removed the patients with contralateral epidural hematoma; group C was first cleared the patients with focus on parts of the epidural hematoma, and immediately implement unilateral or bilateral frontotemporal craniotomy evacuation of hematoma clearance operation and bone flap decompression. After 1 months of follow-up, compared with the effect of surgical treatment, after treatment of the intracranial pressure level, the Glasgow score, and the thickness of the lateral hematoma and the midline shift were compared after treatment. Results: The total effective rate of the C group was 77.42%, significantly higher than that of the A group 50% and B group 43.75%, and the difference was statistically significant (P < 0.05). The average intracranial pressure water in A, C group after 1–10 d was significantly higher than that in B group, and the difference was statistically significant (P < 0.05). The 1–10 d Glasgow scores of C group was significantly higher than that in A group (P < 0.05). The contralateral hematoma thickness and midline shift of the C group were significantly less than that in the A group and the B group, and the differences were statistically significant (P < 0.05). Conclusion: In patients with severe CCBI implementation focus on parts of the epidural hematoma clearance operation combined with bilateral or unilateral to bone flap decompression effect is good, can effectively improve the patients of intracranial pressure, Glasgow Coma Score, reduce shift on the side of the hematoma thickness and midline, the effect is obvious, worthy of recommendation.

1. Introduction

The severe contre-coup brain injury (CCBI) is common in patients with the brain injury, leading to the high disability and mortality. With the advances in the transportation science and technology of China and the increase of living standards, the incidence of severe CCBI have been increased year by year, resulting in the serious impact on the life safety of patients[¹,²]. The clinical treatment of severe CCBI usually relies on the surgical protocol. But because of lacking the unified standards, if only relying on the occupation of hematoma or edema tissue to judge the location of surgery, it would induce the hematoma in the larger range and then affect

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the prognosis of patients[3]. According, the selection of appropriate surgical procedure will be of necessity for the treatment of severe CCBI. In this study, the therapeutic effect of three different surgical procedures was compared, in order to provide the corresponding data support for the clinical treatment of severe CCBI, with the findings as follows.

2. Materials and methods

2.1. Clinical data

A total of 93 patients with the severe CCBI treated in Ankang City Central Hospital from September 2011 to June 2015 were selected in this study. The inclusion criteria[4,5]: (1) The disease diagnosis of patients should be in accordance with the WHO standards regarding the severe CCBI; (2) The disease should be confirmed using the imaging examination; (3) the injury should be caused by the traffic accident or falling and the occipital part is knocked to the ground. The exclusion criteria: (1) non-CCBI disease; (2) patients who die within short period after the operation; (3) patients who have no surgical indications. In this study, there were 54 males and 39 females, with the age range of 21–68 year-old and average age of (40.7±2.8) year-old; Glasgow score of 4–7 points and average one of (5.16±0.49) points. There were 32 subjects in the group B, including 17 males and 15 females, with the age range of 22–67 year-old and average age of (40.4±3.3) year-old; Glasgow score of 3–6 points and average one of (5.14±0.87) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points. According to the different surgical procedures of hematoma evacuation, patients were divided into the groups of A, B and C. Where, there were 30 subjects in the group A, including 18 males and 12 females, with the age range of 21–65 year-old and average age of (41.3±2.4) year-old; Glasgow score of 3–7 points and average one of (5.25±1.24) points.

2.2. Methods

Patients in each group were given the second craniotomy after the clearance of hematoma by the bilateral frontotemporal craniotomy and bilateral decompressive craniectomy and then the clearance of contralateral epidural hematoma. Patients in group C were given the clearance of epidural hematoma at the location of collision and then the clearance of hematoma by the unilateral or bilateral frontotemporal craniotomy and decompressive craniectomy. The operation time for each group should be reduced as far as possible. In case of any symptoms such as the increased intracranial pressure or encephalocele, patients should be given the endotracheal intubation and CT rescanning. The clearance of contralateral epidural hematoma should be performed for patients with the combined cerebral contusion and laceration.

2.3. Main outcome measures

According to one-month follow-up, the therapeutic effect and intracranial pressure after the treatment, Glasgow scores before and after the treatment, and the post-operative thickness of contralateral hematoma and midline shift were compared between groups.

2.4. Effect evaluation[6]

Good: patients have the normal life or mild combined defects; moderate disability: patients have the obvious defects, but can live independently and have the certain job; severe disability: patients should be taken care of by others after the operation. Vegetative state: patients become the vegetative being after the operation; death. The proportion of good and moderate disability is chosen as the response rate.

2.5. Statistical analysis

SPSS13.0 was adopted for the statistical analysis. The \( \chi^2 \) test was employed for the comparison of count data. The measurement data was expressed by (\( \bar{x}\)±s) and its comparison was performed using the t test. \( P<0.05 \) indicated the statistical difference.

3. Results

3.1. Comparison of therapeutic effect after treatment between groups

The total response rate of group C was 77.42%, which was significantly higher than 50.00% of group A and 43.75% of group B, with the statistical difference (\( \chi^2=4.971, 7.458; P=0.026, 0.006 \)). It indicated that the response rate of group C was relatively higher and its therapeutic effect was better, as shown in Table 1.

<table>
<thead>
<tr>
<th>Group</th>
<th>Cases</th>
<th>Good</th>
<th>Moderate disability</th>
<th>Severe disability</th>
<th>Vegetative state</th>
<th>Death</th>
<th>Response rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>30</td>
<td>9(30.00)</td>
<td>6(20.00)</td>
<td>4(13.33)</td>
<td>5(16.67)</td>
<td>6(20.00)</td>
<td>15(50.00)</td>
</tr>
<tr>
<td>Group B</td>
<td>32</td>
<td>8(25.00)</td>
<td>6(18.75)</td>
<td>6(18.75)</td>
<td>4(12.50)</td>
<td>8(25.00)</td>
<td>14(43.75)</td>
</tr>
<tr>
<td>Group C</td>
<td>31</td>
<td>17(54.84)</td>
<td>7(22.58)</td>
<td>3(9.68)</td>
<td>2(6.45)</td>
<td>2(6.45)</td>
<td>24(77.42)*</td>
</tr>
</tbody>
</table>

Compared with group A, \( P<0.05 \); compared with group B, \( P<0.05 \).

Table 1

Comparison of therapeutic effect after treatment between groups [n(%), \( \bar{x}\)±s].
3.2. Comparison of intracranial pressure after treatment between groups

The intracranial pressure of group A and C during 1–10 d after the operation was significantly higher than that of group B, with the statistical difference (t=9.321, 8.466, 7.069, 8.210, 9.273, 4.452; P=0.000, 0.000, 0.000, 0.000, 0.000, 0.000). There was no significant difference in the intracranial pressure during 1–10 d after the operation between group A and group C. It indicated that the intracranial pressure for patients in group B was lower than that in group A and C, but there was no significant difference between group A and group C, as shown in Table 2.

Table 2
Comparison of intracranial pressure after treatment between groups (mmHg, t=5).

<table>
<thead>
<tr>
<th>Group</th>
<th>Case</th>
<th>1 d after operation</th>
<th>5 d after operation</th>
<th>10 d after operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>30</td>
<td>27.53±3.48*</td>
<td>24.37±4.45*</td>
<td>19.28±2.58*</td>
</tr>
<tr>
<td>Group B</td>
<td>32</td>
<td>20.33±2.56</td>
<td>16.61±2.58</td>
<td>14.57±2.66</td>
</tr>
<tr>
<td>Group C</td>
<td>31</td>
<td>26.36±3.24</td>
<td>23.34±3.16</td>
<td>18.33±3.94</td>
</tr>
</tbody>
</table>

Compared with group B, *P<0.05

3.3. Comparison of Glasgow scores before and after treatment between groups

There was no significant difference in Glasgow scores before the treatment between groups. The Glasgow scores of group A and C during 1–10 d after the operation was significantly higher than that of group B, with the statistical difference (t=5.256, 4.286, 6.070, 9.375, 6.012, 7.735; P=0.000, 0.000, 0.000, 0.000, 0.000, 0.000).

The Glasgow scores of group C during 1–10 d after the treatment was relatively higher than that of group A and the Glasgow scores of group A was significantly higher than that of group B, as shown in Table 3.

Table 3
Comparison of Glasgow scores before and after treatment between groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Case</th>
<th>Before operation</th>
<th>1 d after operation</th>
<th>5 d after operation</th>
<th>10 d after operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>30</td>
<td>5.54±0.53</td>
<td>7.12±0.76*</td>
<td>8.32±0.84*</td>
<td>10.22±1.17*</td>
</tr>
<tr>
<td>Group B</td>
<td>32</td>
<td>5.56±0.44</td>
<td>6.25±0.53</td>
<td>7.47±0.72</td>
<td>8.56±0.98</td>
</tr>
<tr>
<td>Group C</td>
<td>31</td>
<td>5.78±0.61</td>
<td>7.74±0.72*</td>
<td>8.63±0.81*</td>
<td>10.64±1.15*</td>
</tr>
</tbody>
</table>

Compared with group B, *P<0.05

3.4. Comparison of post-operative thickness of contralateral hematoma and midline shift between groups

The post-operative thickness of contralateral hematoma and midline shift of group C were all significantly less than that of group A and group B, with the statistical difference (t=20.556, 25.215, 16.050, 15.937; P=0.000, 0.000, 0.000, 0.000). There was no significant difference in the post-operative thickness of contralateral hematoma and midline shift between group A and group B. It indicated that the post-operative thickness of contralateral hematoma and midline shift of group C was lowest, while group A and group B were basically the same, as shown in Table 4.

Table 4
Comparison of post-operative thickness of contralateral hematoma and midline shift between groups (cm).

<table>
<thead>
<tr>
<th>Group</th>
<th>Case</th>
<th>Thickness of contralateral hematoma</th>
<th>Midline shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>30</td>
<td>2.54±0.32</td>
<td>1.64±0.25</td>
</tr>
<tr>
<td>Group B</td>
<td>32</td>
<td>2.66±0.27</td>
<td>1.82±0.33</td>
</tr>
<tr>
<td>Group C</td>
<td>31</td>
<td>1.12±0.21*</td>
<td>0.72±0.20*</td>
</tr>
</tbody>
</table>

Compared with group A, *P<0.05; compared with group B, **P<0.05

4. Discussion

Clinically, the brain injury is the symptom of brain disease that is caused by the external violence directly or indirectly, where the condition of CCBI is mostly complicated. It refers to the contre-coup brain injury because of the violence, usually for the occipital deceleration injury. When the occiput contacts the object, the acting force at the impact point will be relatively large and the counter-impulse position will easily have the severe injuries such as the subdural hematoma and cerebral contusion combined with intracerebral hematoma, leading to the extremely high disability and mortality[7]. For the moment, the main treatment of CCBI is the surgical procedure, but there have been no unified standards. The operators usually decides the position and operation of surgery according to the hematoma or contusion and the occupation of hematoma tissue. It’s common to find the larger contralateral hematoma during or after the operation, with the limited therapeutic effect[8,9]. According, the selection of appropriate surgical procedure will be of necessity for the prognosis of patients. In this study, the therapeutic effect of three different surgical procedures was compared, in order to provide the corresponding data support for the clinical treatment of severe CCBI.

According to the results of this study, the total response rate of group C was 77.42%, which was significantly higher than 50.00% of group A and 43.75% of group B. It indicated that the therapeutic effect of group C was the best, which in accordance with the findings of Yan et al.[10]. Meanwhile, the intracranial pressure of group A and
C during 1–10 d after the operation was significantly higher than that of group B. But there was no significant difference in the intracranial pressure during 1–10 d after the operation between group A and group C. It indicated that the bilateral decompressive craniectomy in group B could significantly improve the intracranial pressure of patients. But the Glasgow scores of group A and C during 1–10 d after the operation was significantly higher than that of group B, with the statistical difference. The Glasgow scores of group C during 1–10 d after the treatment was relatively higher than that of group A. It indicated that the bilateral frontotemporal craniotomy in group B had the poor prognosis. The reason might be that the area of intracranial injury of severe CCBI was relatively large, with the serious degree and long time of bilateral craniotomy[11]. The comparison between group A and group C was not significant, which indicated that the clearance of subdural or epidural hematoma was all preferred option of craniotomy.

Because of the significant impact of midline shift on the intracranial pressure on both sides, it may even aggravate the disease and eventually affect the prognosis. It is thus of critical significance for the observation of midline shift and thickness of contralateral hematoma. According to the results of this study, the post-operative thickness of contralateral hematoma and midline shift of group C were all significantly less than that of group A and group B, with the statistical difference. There was no significant difference in the post-operative thickness of contralateral hematoma and midline shift between group A and group B, but group B was relatively more obvious. It indicated that the bilateral or unilateral frontotemporal craniotomy would cause the midline shift for patients with severe CCBI. But the shift of unilateral frontotemporal craniotomy was much more. The surgical procedure of clearance of epidural hematoma in group C had the least effect, which was basically in accordance with the results of Glasgow scores of group C. Accordingly, the surgical procedure of clearance of epidural hematoma for patients with severe CCBI would be more reasonable, which accorded to the findings of Gardani M et al[12].

In conclusion, the surgical procedure of clearance of epidural hematoma with the bilateral or unilateral decompressive craniectomy will have the good therapeutic effect, which can significantly improve the intracranial pressure and Glasgow scores and reduce the thickness of contralateral hematoma and midline shift with the obvious effects, which is worthy to be popularized in the clinical practice.

References