Diagnostic Value of Membrane Glycolipids Biochemistry Index in Intracranial and Gastrointestinal Tumors

Jun Lv, Can-Qun Lv*, Ping Mei, Shi-Mei Qi

Abstract

The diagnostic value of membrane glycolipid biochemistry index, the lipid-bound sialic acid (LSA) and total sialic acid (TSA) in cerebrospinal fluid (CSF) was evaluated in 30 intracranial and 65 gastrointestinal tumors. The plasma LSA, TSA and red cell membrane sialic acid (R-SA) in were determined according to the method of Sevenmerhulm. Our results showed that the levels of LSA and TSA in CSF of intracranial tumor patients was higher than that of normal group (p<0.01). The concentration of TSA and LSA in patients with malignant glioma was higher than that of benign meningioma patients (P<0.01). No significance was found between intracranial halmatoma patients and normal control group for levels of membrane glycolipids (p>0.05). Results also found that the plasma LSA, TSA and R-SA of gastric carcinoma were significantly higher than those of control group (p<0.05); while no significant difference was found in the plasma LSA, TSA and R-SA levels between chronic gastritis, gastroheloma and normal control group (p>0.05). Plasma LSA, TSA and R-SA levels of gastric carcinoma patient were significantly higher than those of chronic gastritis patients and gastroheloma patients (p<0.05). It was also found that plasma LSA, TSA and R-SA contents were significantly higher in large intestine carcinoma patients than in benign in stestine tumor patients (p<0.05) while no significant difference was found between intestine benign tumor and normal control group (p>0.05). The levels of LSA, TSA and R-SA were obviously higher in the patients with metastasis than in the ones without (p<0.05) . The membrane glycolipid biochemistry index LSA and TSA in CSF are sensitive markers for diagnosing intracranial tumors. For gastrointestinal malignant tumors the plasma LSA TSA and red blood cell membrane SA may be considered as auxiliary indicators for diagnosis. They can be used for distinguishing benign from malignant tumors.

Keywords: Membrane glycolipid - ganglioside - cerebrospinal fluid - intracranial tumor - gastroinstinal tumor
also recruited in this study, which consist of 35 subjects
with gastric carcinoma and 30 patients with colorectal
carcinoma. Among the 65 case, 12 case with metastasis,
8 cases without metastasis. Informed consent was
obtained, and the study protocol was approved by the
Ethics Committee of Wannan Medical College. The
contents of LSA, TSA and R-SA were determined based
on the method of Sevennerholm progress improde.
The genglioside extrction and purification was performed,
the extraction steps used chloroform (C), methanol (M) and
water (W) in a final volume ratio 1:1:0.8 (C: M: W) (v/v/v),
upper phases containing gangliosides were collected and
air-dried, and obtained dry ganglioside extract was finally
purified by dialysis and get-filtration. Purified ganglioside
extract was used for quantitative analysis. The plasma
LSA, TSA of cerebrospinal fluid (CSF) for intracranial
tumors and the LSA, TSA and R-SA in gastrointestinal
tumors was determined by resorcinol spectrometric
method. The plasma was isolated from the whole blood
by routine laboratory method, the plasma and red blood
cells was finally separated by centrifugation. The red
blood cells membrane was extracted from the red blood
cell add water solve.

Statistical analysis
All statistical analyses were performed by SPSS,
version13.0. Unpaired Student’s t-test was used to
compare the level of membrane glycolipids biochemistry
index, the lipid-bound sialic acid (LSA) and total sialic
acid (TSA) between two groups. The results were
presented as the means (±SD). A two-tailed P value of
0.05 was defined to be statistically significant.

Results
Table 1 shows that the levels of LSA in CSF of
subjects with maligand glioma and benign menigioms were
higher than that of normal control group (P <0.01). No
significance difference was found between subjects with
intracranial hematomat and normal control group (p>0.05).
The levels of TSA in CSF of maligand glioma patients
were higher compared to normal control group (p<0.05).
The levels of TSA in benign menigios and metastatic
brain tumors were higher compared to normal control
group. No significance was found between subjects with
intracranial hematomat and normal control group for TSA
levels (p>0.05). As showed in Table 2.

Table 3 shows the plasma level of LSA. TSA and
R-SA in subjects with gastric carcinoma were significantly
higher than those of normal control group (p<0.05).
However, no significant difference was founded in the
plasma LSA, TSA and R-SA levels among chronic
gastritis, gastrohelcoma and normal control group (p>0.05). Plasma level of LSA, TSA and R-SA in subjects
with gastric carcinoma were significantly higher than those
of chronic gastritis patients and gastrohelcoma patients
(p<0.05).

Table 4 showed that plasma level of LSA, TSA
and R-SA in subjects with large intestine carcinoma

Table 1. Compares Level of Total Sialic Acid (TSA) in
CFS among Different Groups

| Group                   | n | LSA(u g/ml) | P       |
|-------------------------|---|-------------|---------|
| Maligand glioma*        | 12| 9.96±1.01   | <0.05   |
| Benign menigioms*       | 10| 6.30±0.76   | <0.05   |
| Metastatic brain tumors | 8 | 10.12±0.98  | <0.05   |
| Intracranial halmatoma  | 8 | 4.25±0.79   | >0.05   |
| Normal control group    | 20| 21.5±3.4    |         |

Table 2. The Level of TSA in CSF among Different
Groups

| Group                   | n | LSA(ug/ml) | P-value |
|-------------------------|---|------------|---------|
| Maligand glioma*        | 12| 31.3±5.4   | <0.05   |
| Benign menigioms*       | 10| 26.7±4.5   | <0.05   |
| Metastatic brain tumors | 8 | 32.2±4.1   | <0.05   |
| Intracranial halmatoma  | 8 | 20.1±2.9   | >0.05   |
| Normal control group    | 20| 21.5±3.4   |         |

Table 3. Comparison of Membrane Glycolipid Levels among Subjects with Gastric Carcinoma, Gastrohelcoma
and Chronic Gastritis

| Group                   | n  | TSA(ug/ml) | LSA(ug/ml) | R-SA(0.1ug/ml) | P-value |
|-------------------------|----|------------|------------|----------------|---------|
| Gastric carcinoma       | 35 | 1122.69±158.89| 346.77±61.59| 26.94±5.11     | <0.05   |
| Chronic gastritis*      | 20 | 928.65±125.30| 263.30±56.2 | 21.76±3.9      | <0.05   |
| Gastrohel-coma*         | 20 | 951.76±112.04| 270.12±53.6 | 22.56±5.89     | >0.05   |
| Normal control group    | 50 | 934.04±132.91| 266.45±57.43| 22.11±4.37     |         |

Table 4. Membrane Glycolipids Level compare of Benign tand Malignant Intestinal Tumors

| Group                   | n  | TSA(ug/ml) | LSA(ug/ml) | R-SA(ug/ml) | P-value |
|-------------------------|----|------------|------------|-------------|---------|
| Intestine maligand tumor*| 30 | 1131.2±156.3 | 370.12±62.5 | 28.13±5.35 | <0.05   |
| Intestine benign tumor   | 18 | 950.16±20.84 | 272.36±59.32| 22.21±4.98 | >0.05   |
| Normal control group    | 50 | 934.04±132.91| 266.45±7.43 | 22.11±4.37 |         |

Table 5. Membrane Glycolipid Levels of Intestine Tumor with and without Tumor Metastasis

| Group                   | n  | TSA (ug/ml) | LSA (ug/ml) | R-SA (ug/ml) | P-value |
|-------------------------|----|-------------|-------------|--------------|---------|
| Tumor with metastasis   | 12 | 1196.9±124.36| 401.32±67.58| 30.81±5.03  | <0.05   |
| No metastasis tumor     | 10 | 1057.16±123.58| 385.20±59   | 22.12±4.03  | <0.05   |
| P-value                 |    | <0.05       | <0.05       | <0.05       |         |
were significantly higher than that of subjects with the benign intestine tumor (p<0.05). However, no significant difference was founded between intestine benign tumor and normal control group (p>0.05). The membrane glycolipid levels in subjects with intestine malignand tumor patient was higher than that of subjects with benign tumor (p<0.05).

Table 5 showed the levels of TSA, LSA and R-SA in subjects with intestine tumor metastasis were higher than those without metastasis (P <0.05).

Discussion

The result of our present study is in accordance with determine of sialic acid content. The levels of LSA and TSA in CSF was higher in subjects with intracranial tumor compared to normal control group, the content of TSA and LSA in subjects with malignant glioma was higher than that of subjects with benign meningiomas. The present study revealed that plasma LSA, TSA and R-SA levels of gastric carcinoma were significantly higher than those of normal control group. While no significant difference was found in the plasma LSA, TSA and R-SA levels among chronic gastritis, gastrohelcoma and normal control group. The plasma LSA, TSA and R-SA levels of gastric carcinoma patient were significantly higher than those of chronic gestritis patients and gastrobelecoma patients. It was also found that plasma LSA, TSA and R-SA contents were significantly higher in large intestine carcinoma patient than in benign intestine tumor patients, while no significant difference was found between intestine benign tumor and normal control group. The levels of LSA, TSA and R-SA were obviously higher in the patients with metastasis than those without metastasis.

Gangliosides (GLs) is an acidic glycosphingolipid containing N-acetylglycosamine and ubiquitous in the central nervous system. The term “ganglioside” is meant for the GSL containing sialic acid. The sialic acid (SA) is the generic term given to a family acetylated derivative of neuraminic acid. A main function of host SA is to regulate innate immunity sialic acid occupies the interface between the host and pathogenic microorganisms. Acute phase inflammation has been suggested to associate with infection disease such as periodontal diseases (Pyo et al., 1999; Rusnati et al., 1999).

Sialic aid is a marker of the acute-phase response. Furthermore, it is a precursor of several systemic disorders, Cardiovascular disease, rheumatoid arthritis, and diabetes (Iijima et al., 2004; Baenke et al., 2013). Gangliosides are well known for their role in the mediation of several diseases such as tetanus, botulism and influenza by acting as cellular receptors for invading pathogens (Stringou et al., 1992; Ariga et al., 2010). While gangliosides of mature brain such as GM1, may be neuroprotective in some circumstances, other ganglioside have long been thought to play an intricate role in the process of cell death in diseases of the central nervous system (Park et al., 2008).

Numerous previous studies reported that higher concentration of plasma or serum gangliosides in cancer patients and acute phase inflammation patients comparing healthy individual, but the mechanism is still unclear (Busu et al., 2012). The following reason may properly explain the mechanisms of gangliosides levels raised in intracranial tumors and gastrointestinal tumors. Firstly, the sudden change of exist chromatin cancer gene due to physical, chemical or biological factor (Byers et al., 2012). Additional, those glycolipid glycosyltransferases activity was remarkable increase lead to membrane glycolipid biosynthesis ability strengthen (Suzuki et al., 2011). It is has been observed that, tumor cell of neuroectodermal origin may shed their gangliosides into circulation, resulting in higher ganglioside concentration in CSF of intraeranal tumors and plasma of gastrointestinal tumors (Radic et al., 2008).

In conclusion, the membrane glycolipid biochemistry index LSA and TSA in CSF are sensitive markers for diagnosing intracranial tumors, they have certain significance for identifying malignant tumors from benign ones. In gastrointestinal tumors, the membrane glycolipids biochemistry index plasma LSA, TSA and red blood cell membrane SA may be considered as an auxiliary indicator for diagnosis gastrointestinal malignant tumors. It can be used for distinguishing benign tumors form malignant ones. It can also be regarded as an unspecific indicator for judging tumor metastasis.

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