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Plasma Sialic Acid Levels in Normal Beagles

By
Wm. Fuller*
and
R. L. Engen, B.S., M.S., Ph.D.†

Glycoproteins are found in cell membranes, plasma and in various secretions. Many plasma proteins have carbohydrates covalently bound to them. Carbohydrate units will contain hexoses, N-acetylglucosamine, N-acetylgalactosamine, fucose and sialic acid (N-acetylneuraminic acid). The role of the carbohydrate unit has been disputed. There is evidence that the carbohydrate unit is essential for the activity of some specific hormones, enzymes and other physiological compounds and the converse has been shown. The role of the carbohydrate unit could be passive, necessary for specific biological activity or necessary as a transport or carrier agent from producing cells (11).

Sialic acid is found in a normal animal's blood bound to the plasma globulins, red blood cells to a slight degree, to fibrinogen (4) and to circulating hormones. Serum does not contain free sialic acid, lipid-bound sialic acid, albumin-bound sialic acid, or hemoglobin-bound sialic acid. Concentrations of sialic acid vary depending on species from 43 to 74 mg% (5). It has been shown in many disease conditions that serum globulins increase. It has also been shown that total sialic acid levels have increased in these disease conditions paralleling the serum globulin levels. Since N-acetylneuraminic acid is present in very appreciable amounts in the α- and β-globulins, it is believed that the increase in serum globulins is reflected in elevated N-acetylneuraminic acid (11).

A study was done with the assumed measles virus, paramyxovirus, in relation with N-acetylneuraminic acid. Neuraminidase activity was associated with the measles hemagglutinin. Evidence suggested that the enzyme was part of the viral envelope. Incubation of concentrated measles virus with neuraminidase resulted in the liberation of N-acetylneuraminic acid (6). In another study with influenza virus, sialic acid appeared to have a defensive role by inhibiting the influenza virus hemagglutinin (12). Serum sialic acid increases have been reported in tuberculosis, hepatitis, and polyarthritis (5, 7).

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Serum sialic acid values have been elevated by steroid treatment (2) and dogs with distemper have shown elevated serum sialic acid values (3). In order to determine if serum sialic acid is correlated with globulin increases, studies were initiated to determine the extent of the sialic gamma globulin relationship.

Materials and Methods

Six beagle dogs were evaluated for plasma sialic acid and protein. A blood sample from each was taken for plasma. Various dilutions of saturated (NH₄)₂SO₄ were used to precipitate the gamma globulin fraction (8). Electrophoresis was done on samples from the supernatant to determine the dilution of (NH₄)₂SO₄ required to precipitate only gamma globulins (9). This dilution was 30% (NH₄)₂SO₄. Plasma protein quantities were determined by the Biuret Method. Protein concentrations were determined in the supernatant of the 30% (NH₄)₂SO₄ precipitations. The difference between supernatant protein concentration and the plasma protein concentration represents the gamma globulins precipitated.

Total plasma sialic acid quantities were determined by hydrolyzing the plasma with trichloroacetic acid and analyzing the hydrolysate for sialic acid by the automated Thiobarbituric Acid Assay Method (1, 10). Sialic acid bound to protein will remain bound to protein upon its precipitation by NH₄SO₄. Supernatants from the 30% (NH₄)₂SO₄ precipitations were hydrolyzed and analyzed from sialic acid concentration. The difference between the concentration of total sialic acid in the plasma and the sialic acid in the supernatant of the (NH₄)₂SO₄ precipitation represents the amount of sialic acid bound to gamma globulin.

Results

Total protein values ranged from 6.1 gram % to 6.4 g%. The mean was 6.2 ± 0.04 g%. Total sialic acid values ranged from 55.8 to 59.3 mg%. The mean was 57.6 ± 0.53 mg%. The ratio of total sialic acid to total protein ranged from 9.0 to 9.6 mg/g. The mean was 9.3 ± 0.08 mg/g.

Gamma globulin values ranged from 0.60 g% to 0.92%. The mean was 0.75 ± 0.01 g%. Sialic acid bound to gamma globulin ranged from 5.0 mg% to 6.7 mg%. The mean was 6.07 ± 0.03 mg%. The ratio of gamma globulin bound sialic acid to gamma globulin ranged from 8.3 ± 0.6 mg/g.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Concentrations of Total Protein, Total Sialic Acid, Protein Fractions and Sialic Acid Fractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>Dog 1</td>
</tr>
<tr>
<td>Total Plasma Protein g%</td>
<td>6.10</td>
</tr>
<tr>
<td>Protein in 30% NH₄SO₄ Plasma Supernatant g%</td>
<td>5.45</td>
</tr>
<tr>
<td>Gamma Globulin g%</td>
<td>0.65</td>
</tr>
<tr>
<td>Total Plasma Sialic Acid mg%</td>
<td>58.7</td>
</tr>
<tr>
<td>Sialic Acid in 30% NH₄SO₄ Plasma Supernatant mg%</td>
<td>52.2</td>
</tr>
<tr>
<td>Gamma Globulin Bound Sialic Acid mg%</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Issue, No. 1, 1971
### Table 2: Ratios of Sialic Acid to Protein

<table>
<thead>
<tr>
<th>Dog</th>
<th>Total Plasma Sialic Acid to Total Plasma Protein (mg/g)</th>
<th>Gamma Globulin Bound Sialic Acid to Gamma Globulins (mg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.6</td>
<td>10.0</td>
</tr>
<tr>
<td>2</td>
<td>9.3</td>
<td>8.9</td>
</tr>
<tr>
<td>3</td>
<td>9.3</td>
<td>7.2</td>
</tr>
<tr>
<td>4</td>
<td>9.0</td>
<td>6.7</td>
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<tr>
<td>5</td>
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<td>6.7</td>
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<tr>
<td>6</td>
<td>9.2</td>
<td>10.0</td>
</tr>
<tr>
<td>X</td>
<td>9.3</td>
<td>8.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>0.2</td>
<td>1.58</td>
</tr>
<tr>
<td>S.E.M.</td>
<td>0.08</td>
<td>0.6</td>
</tr>
</tbody>
</table>

**Discussion**

The data in tables 1 and 2 presents normal values.

With future study sialic acid may prove to be useful in clinical pathological diagnosis in disease conditions in which sialic acid concentrations increase over normal concentrations. It also may be shown that sialic acid is an intricate part of the body defense mechanism or is associated with the body defense mechanism.

**REFERENCES**


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**Feline Urethral Obstruction**

**By T. A. Silberhorn***

**Introduction**

Urethral occlusion due to urinary calculi or mucous plugs is a serious and fairly common problem of the male cat. Surgical treatment of urethral obstruction cases usually involves removal of the obstruction and relief of urine retention. Methods commonly used to achieve this include: irrigation of the urethra, retrograde passage of metal or plastic catheters, use of alligator forceps, or gentle expression of the urinary bladder through the abdominal wall. In many of these cases, the condition recurs within a short time and becomes chronic, or the obstruction cannot be removed by the above methods. This article reviews such a problem case and the surgical procedure used to correct it.

**Case History**

A male Siamese cat was presented to Valverde Animal Clinic, Corrales, New Mexico. The cat was 2 years old and had been V. W. H.R. and M. E. J.: Isolation of Neuraminidase from Influenza virus. Bio. Prep., 10: 113-117. 1963.