Mannan-binding lectin (MBL) serum levels and post-operative infections

M. Siassi1, W. Hohenberger and J. Riese
Department of Surgery, University of Erlangen-Nürnberg, Erlangen, Germany

Abstract
Mannan-binding lectin (MBL) is a central component of the innate immune system. Here we investigated the role of MBL in surgical patients during the peri-operative phase. Basal and post-operative (days 1–3 post-surgery) serum samples were obtained prospectively from 156 patients undergoing major elective gastrointestinal surgery for malignant disease. In contrast to procalcitonin (a typical acute-phase protein), there was no significant difference in serum MBL between pre- and post-operative samples \(P = 0.62\). Nevertheless, patients who developed post-operative infections showed significantly lower pre- and post-operative MBL levels than those who did not \(P = 0.013\) and \(P = 0.005\), respectively. There was no significant difference in pre-operative procalcitonin between the two groups \(P = 0.56\). We conclude (i) that serum MBL levels did not respond immediately to surgical trauma, and (ii) that lower MBL levels were associated with an increased occurrence of post-operative infections. Studies on larger patient groups are necessary, however, to assess the value of MBL measurements in identifying patients at risk of post-operative complications.

Introduction
Mannan-binding lectin (MBL) is a central part of the innate immune system. It belongs to the human collectin family encoded by a gene cluster on chromosome 10. The basic subunit of the molecule consists of three polypeptide chains of 24 kDa linked by disulphide bonds at the N-terminus. These subunits combine to form a series of oligomers. This tertiary structure enables multiple binding to repeating oligosaccharide structures typical of bacterial surfaces. Since human cells do not usually carry such carbohydrate patterns on their surfaces, MBL can generally only bind with low affinity to single saccharides on human cells [1]. In contrast, experimental studies have confirmed relatively strong binding of MBL to bacteria like Neisseria meningitidis, Haemophilus influenzae and Escherichia coli, viruses like HIV-1 and -2 and fungi like Candida albicans and Cryptococcus neoformans. After surface binding, MBL activates MBL-associated serine protease-2 (MASP-2) and hence the lectin pathway of complement activation [2].

The MBL concentration in serum is in part determined genetically. Some haplotypes confer low MBL concentrations or the secretion of non-functional protein. Altogether, a third of the population may have insufficient MBL serum levels [3]. Previous studies have shown an increased susceptibility to bacterial, viral or fungal infections in patients with decreased serum MBL levels [4,5]. These studies also showed an increase in serum MBL concentrations after infection. One study also showed an increase in MBL concentrations after surgery [6]. MBL was therefore considered to be an acute-phase protein. We therefore investigated whether MBL serum levels showed an increase after surgical stress, and whether pre-operative MBL levels were of predictive value for the occurrence of post-operative infections.

Materials and methods
We investigated 172 consecutive patients who underwent elective gastrointestinal resections for malignant disease of the gastrointestinal tract in our institution. Exclusion criteria were ages below 18 or above 80 years, pre-existing infection and emergency surgery. Patients were followed up clinically and all post-operative complications were recorded according to the criteria of the American Council of Chest Physicians/Society of Critical Care Medicine. Complications were termed ‘post-operative infection’ when signs of sepsis or SIRS (systemic inflammatory response syndrome) occurred with no obvious bacterial contamination or specific surgical problem (i.e. anastomotic leakage).

Blood samples were taken pre-operatively and on days 1–3 post-operatively; serum was stored at \(-76\)°C. MBL measurements were done by ELISA (Statens Serum Institut, Copenhagen, Denmark). As a reference, procalcitonin, a well-known acute-phase protein, was measured. Statistical comparisons were made using the Wilcoxon test (SPSS Software, Munich, Germany).

The study was approved by the University Ethics Committee and all patients gave informed consent for participation in the study.

Results
The mean pre- and post-operative MBL serum concentrations of all patients were 2462 ± 175 and 2375 ± 160 ng/ml, respectively \(P = 0.6\). In contrast, the mean serum levels of procalcitonin rose from 0.24 ± 0.1 to 1.5 ± 0.17 ng/ml \(P < 0.05\).
Table 1 | Post-operative complications in the patient group (n = 172)

<table>
<thead>
<tr>
<th>Complication</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anastomotic leakage</td>
<td>12</td>
</tr>
<tr>
<td>Aspiration</td>
<td>2</td>
</tr>
<tr>
<td>Catheter sepsis</td>
<td>4</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2</td>
</tr>
<tr>
<td>Abdominal abscess</td>
<td>3</td>
</tr>
<tr>
<td>Urinary-tract infection</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
</tr>
</tbody>
</table>

There were 24 septic post-operative complications (Table 1). In patients who developed a post-operative infection, the mean pre-operative MBL level was 1332 ± 466 ng/ml compared with 2523 ± 181 ng/ml in patients who did not develop infections (P = 0.013; Figure 1). The mean post-operative MBL-concentration was 1156 ± 393 ng/ml in patients with infections and 2442 ± 166 ng/ml in patients without infections (P = 0.005).

Conclusions
In contrast to an earlier study [6], serum levels of MBL did not show an increase after elective major surgery. This may be due to the relatively short post-operative observation period. In our study, MBL clearly did not show behaviour associated with acute-phase proteins.

Patients who developed post-operative infections showed significantly lower pre- and post-operative MBL levels than patients who did not. In contrast, there was no association of pre-operative serum MBL with the occurrence of anastomotic leaks. In our study, the sample size did not allow multivariate analysis. Therefore, studies on larger patient groups are necessary to determine whether or not MBL is an independent risk factor for post-operative infections. A follow-up study will deal with the influence of different genotypes on the post-operative course.

References

Received 1 April 2003