Table 1. Comparison of sperm parameters and ORP levels between study groups (values are median [25th, 75th percentile]).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients with varicocele (n=56)</th>
<th>Control (n=51)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (mL)</td>
<td>3.1 (2.1, 4.3)</td>
<td>2.5 (1.7, 3.4)</td>
<td>0.017</td>
</tr>
<tr>
<td>Sperm concentration</td>
<td>14.15 (5.32, 41.35)</td>
<td>45 (22.57, 79.8)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Total Motility (%)</td>
<td>36.5 (29, 48.5)</td>
<td>48 (43, 58)</td>
<td>0.006</td>
</tr>
<tr>
<td>Morphology (Kruger: normal &gt;4%)</td>
<td>41.6 (28, 57.6)</td>
<td>57.6 (40, 61.2)</td>
<td>0.001</td>
</tr>
<tr>
<td>ORP (mV/10e6 sperm/mL)</td>
<td>2.56 (1.1, 1.68)</td>
<td>1.35 (0.77, 1)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Comparison of normal and abnormal sperm parameters and ORP levels (median [25th, 75th percentile]) in patients with varicocele (n=56) with oligozoospermic versus non-oligozoospermic, asthenozoospermic versus non-asthenozoospermic, teratozoospermic versus non-teratozoospermic patients.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Patients with at least one abnormal parameter (n=55)</th>
<th>Patients with normal sperm parameters (n=51)</th>
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Figure 1. The MÖSIKS System showing A: Analyzer and B: Sensor strip for loading the sample.

Figure 2. A: Correlations between serum parameters and ORP in all patients with varicocele (n=56). B: Correlation between ORP levels and ORP levels with at least 1 abnormal sperm parameter.

CONCLUSIONS

1. Significant negative correlations were seen between ORP levels and total sperm count and total motility both in patients with at least 1 abnormal semen parameter (Figure 5).

2. Significant higher ORP levels were seen in infertile men with varicocele (P<0.001).

3. Comparison between infertile men with varicocele and normal healthy men

   a. Semen parameters and ORP level in varicocele versus control group is shown in Table 1.

   b. All semen parameters except ejaculate volume were significantly lower in varicocele men (P<0.001).

   c. Significantly higher levels of ORP were seen in infertile men with varicocele (P<0.001).

   d. Comparison of normal and abnormal sperm parameters and ORP levels in patients with varicocele

   i. 76.5% (45/56) infertile men with varicocele had at least 1 abnormal sperm parameter according to WHO 5th edition guidelines. Oligozoospermia: sperm concentration <15 x 10^6 sperm/mL, asthenozoospermia total motility <40% or <32% vs. ORP levels: suggest a higher state of OS.

   ii. Of the 56 infertile men with varicocele, 64.3% (36/56) had unilateral and 35.7% (20/56) had bilateral varicocele.

   iii. Our result show that both sperm parameters and ORP values distinguished infertile patients with varicocele from normal healthy men. The elevated ORP levels further support the role of OS as an underlying mechanism in infertility in varicocele patients.

MATERIALS AND METHODS cont.

Table 2. Comparison between infertile men with varicocele and normal healthy men...

1. All semen parameters except ejaculate volume were significantly lower in varicocele men (P<0.001).

2. Significantly higher levels of ORP were seen in infertile men with varicocele (P<0.001).

3. Correlation between unilateral and bilateral varicocele grade of varicocele

   a. The 56 infertile men with varicocele, 64.3% (36/56) had unilateral and 35.7% (20/56) had bilateral varicocele.

   b. The semen parameters and ORP levels were comparable between the two groups.

   c. When varicocele patients were divided according to the varicocele grade i.e. grade 1: 50 (25/56); grade 2: 26.8% (15/56) and grade 3: 23.3% (13/56), no significant differences were seen in any of the above parameters.

   d. Comparisons of normal and abnormal sperm parameters and ORP levels in patients with varicocele

   1. 76.5% (45/56) infertile men with varicocele had at least 1 abnormal sperm parameter according to WHO 5th Edition guidelines. Oligozoospermia: sperm concentration <15 x 10^6 sperm/mL, asthenozoospermia total motility <40% or <32% vs. ORP levels: suggest a higher state of OS.

   2. All uninfertile and ORP levels in patients with varicocele

   a. 29.8% (56/188) infertile men with varicocele had at least 1 abnormal sperm parameter according to WHO 5th Edition guidelines.

   b. Comparisons of normal and abnormal sperm parameters and ORP levels in patients with varicocele

   i. Comparisons of normal and abnormal sperm parameters and ORP levels in patients with varicocele

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   iii. Significant differences in ORP levels were observed in oligozoospermic versus non-oligozoospermic, asthenozoospermic versus non-asthenozoospermic, teratozoospermic versus non-teratozoospermic patients and those with at least one of these abnormalities versus those without.

   iv. Significant differences in ORP levels were observed in oligozoospermic versus non-oligozoospermic, asthenozoospermic versus non-asthenozoospermic, teratozoospermic versus non-teratozoospermic patients.

   v. Correlation between ORP and semen parameters in patients with varicocele

   a. Significant negative correlations were seen between ORP levels and total sperm count and total motility both in all patients as well as in patients with at least 1 abnormal sperm parameter (Figure 2).

   b. Comparison of normal and abnormal sperm parameters and ORP levels in patients with varicocele

   i. Significant negative correlations were seen between ORP levels and total sperm count and total motility both in patients with at least 1 abnormal sperm parameter (Figure 2).

   ii. Significant higher ORP levels were seen in infertile men with varicocele (P<0.001).

   iii. Comparison between infertile men with varicocele and normal healthy men

   a. Semen parameters and ORP level in varicocele versus control group is shown in Table 1.

   b. All semen parameters except ejaculate volume were significantly lower in varicocele men (P<0.001).

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