Metabolic Syndrome with Different Antipsychotics: A Multicentre Cross-Sectional Study

By Cem Cerit, Meltem Vural, Şükriye Boğelmez, Eylem Özten, Ahmet Tamer Aker, Mustafa Yıldız

ABSTRACT ~ Objective: High prevalence of Metabolic Syndrome (MS) and related metabolic disturbances in patients with schizophrenia and bipolar affective disorder have been in main focus of interest in recent years since the introduction of second-generation antipsychotics. This study aims to examine these questions: 1) Is there a relation between antipsychotic treatment and MS prevalence? 2) Which antipsychotic users have higher MS prevalence? 3) Do patients on antipsychotic polytherapy have higher rates of MS than patients on antipsychotic monotherapy? 4) Which metabolic parameters are considerably disturbed on which antipsychotic users? Methods: 242 Patients with schizophrenia, schizoaffective disorder and bipolar disorder without any other psychiatric comorbidity according to DSM-IV and using the same antipsychotic(s) and/or mood stabilizers at least for the last 6 months included to the final assessment. Results: The sample was divided into 7 drug groups. The MS prevalence was highest in the combined antipsychotic (AA) group (48.1%) according to ATP III criteria. According to IDF criteria clozapine (C) group had the highest MS prevalence (74%). Conclusions: When metabolic parameters evaluated overall, metabolic risk with antipsychotics is found to be highest in clozapine group, followed by combined AP group. Olanzapine and risperidone have intermediate risk while zuclopenthixole has lowest. Psychopharmacology Bulletin. 2010;43(4):22–36.

INTRODUCTION

Metabolic Syndrome (MS) in patients with severe mental illnesses has received growing attention since the introduction of second-generation antipsychotics.

Drs. Cerit, MD, Vural, MD, Psychiatry Specialist, Haydarpasa Numune Training and Research Hospital, Istanbul, Turkey. Dr. Boğelmez, MD, Psychiatry Specialist, Kocaeli Derince State Hospital, Kocaeli, Turkey. Dr. Öztén, MD, Psychiatry Specialist, Kocaeli University Faculty of Medicine, Kocaeli, Turkey. Drs. Tamer Aker, MD, PhD, Yıldız, MD, Professor of Psychiatry, Kocaeli University Faculty of Medicine, Kocaeli, Turkey.

To whom correspondence should be addressed: Dr. Cem Cerit, MD, Haydarpasa Numune Training and Research Hospital, Psychiatry Clinic, Istanbul, Turkey. Phone: +90 505 6164690; E-mail: cemcerit@yahoo.com
MS which main ethiological factor is insulin resistance\(^1\) consists of increased central obesity, disturbed lipid profiles causing atherosclerosis, increased blood pressure and increased fasting blood glucose levels. Definitions of metabolic syndrome are shown in Table 1. Most widely used definition is American National Cholesterol Education Programme Third Adult Treatment Panel (Adult Treatment Panel III, 2001).\(^2\) Another definition is constituted by International Diabetes Federation (IDF) (International Diabetes Federation, 2005).\(^3\)

Metabolic syndrome is related with increased risk of diabetes,\(^1\) cardiovascular diseases\(^4\) and mortality.\(^5\) Patients diagnosed with MS have 3-fold increased risk for stroke and coronary artery diseases and 6-fold increased risk for cardiovascular mortality.\(^4\)

Cardiovascular risk factors like obesity and diabetes are 1.5–2 times higher in patients with schizophrenia than general population.\(^6\) Compared with the general population, persons with schizophrenia have up to a 20% shorter lifespan, with cardiovascular disease as the leading cause of death.\(^7\) Smoking, poverty, poor nutrition, and reduced access to medical care may be risk factors for MS in persons with schizophrenia.\(^7\) Obesity, decreased physical activity and antipsychotic treatment may be additional risk factors for MS.

Publications reporting high prevalence of MS and related metabolic disturbances in patients with schizophrenia and bipolar affective disorder have been in main focus of interest in recent years. Mc Evoy et al. found

### TABLE 1

<table>
<thead>
<tr>
<th></th>
<th><strong>ATP-III</strong></th>
<th><strong>IDF</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference (cm)</td>
<td>Male $&gt;102$</td>
<td>Male $&gt;94$</td>
</tr>
<tr>
<td></td>
<td>Female $&gt;88$</td>
<td>Female $&gt;80$</td>
</tr>
<tr>
<td>Blood Pressure (mm/hg)</td>
<td>$\geq 130/85$ or on antihypertensive medication</td>
<td>$\geq 130/85$ or on antihypertensive medication</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>Male $&lt;40$</td>
<td>Male $&lt;40$</td>
</tr>
<tr>
<td></td>
<td>Female $&lt;50$</td>
<td>Female $&lt;50$</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>$\geq 150$</td>
<td>$\geq 150$</td>
</tr>
<tr>
<td>Fasting blood glucose (mg/dl)</td>
<td>$\geq 110$ or on insulin or hypoglycemic medication</td>
<td>$\geq 100$ or on insulin or hypoglycemic medication</td>
</tr>
</tbody>
</table>

The National Cholesterol Education Program ATP III defines patients with the metabolic syndrome as having 3 or more of the risk factors in Table 1. Based on IDF definition, waist circumference is the obligatory criteria and additional 2 criteria are required for MS diagnosis.

\(^1\)Adult Treatment Panel III \(^2\)International Diabetes Federation
that prevalence of MS in patients with schizophrenia was 40.9% according to ATP III criteria. De Hert et al. reported that MS prevalence in patients with schizophrenia was 28.4% and 36% respectively according to ATP III and IDF criteria. According to ATP-III criteria, MS prevalence in patients with bipolar affective disorder was reported 30% in a study.

Association between atypical antipsychotics and metabolic problems in patients with schizophrenia have been widely discussed recently. Newly diagnosed diabetes cases during atypical antipsychotic treatment have been reported. However, it has been not clearly answered yet whether the association between MS and schizophrenia is related with atypical antipsychotics or independent from drug treatment.

Correll et al. indicated that high prevalence of metabolic syndrome in patients receiving second-generation antipsychotics doubles the 10-year risk of coronary heart disease events in this population. Another study investigating metabolic effects of atypical antipsychotics showed that 12-week olanzapine or risperidone monotherapy is associated with increased body weight, cholesterol, and triglyceride levels.

Data from a study comparing antipsychotic monotherapy versus antipsychotic polytherapy revealed that patients receiving antipsychotic polytherapy have higher rates of metabolic syndrome and lipid markers of insulin resistance. Clozapine and olanzapine have higher risk, and aripiprazole and ziprasidone have lower risk for MS.

Yumru et al. reported that MS prevalence in patients with bipolar affective disorder in a Turkish population is higher in patients receiving only atypical antipsychotics compared with patients on only mood stabilizers and patients on both atypical antipsychotics and mood stabilizers.

The amount of weight gain differs among atypical antipsychotics. Clozapine and olanzapine treatments are associated with the greatest risk of clinically significant weight gain followed by risperidone and quetiapine. Ziprasidone and aripiprazole treated patients demonstrated the lowest weight gain.

Atypical antipsychotics are associated with hyperglycemia and hyperlipidemia. Wirshing and Boyd observed blood glucose levels before and after antipsychotic treatment. Patients treated with clozapine, olanzapine or haloperidol had statistically significant increase in blood glucose levels, while patients treated with risperidone or fluphenazine had no significant change in blood glucose levels. Tandon and colleagues reported that the risk of atypical antipsychotics causing hyperlipidemia are respectively clozapine, olanzapine, quetiapine = risperidone, ziprasidone = aripiprazole from highest to lowest. Another study found that clozapine and olanzapine were associated with an increase in cholesterol and triglyceride levels. The effects of clozapine and olanzapine on the glucose and lipid metabolism outweighed those of risperidone and sulpiride.
With the incitement of all these data, this study aims to examine these questions: 1) Is there a relation between antipsychotic treatment and MS prevalence? 2) Which antipsychotic users have higher MS prevalence? 3) Do patients on antipsychotic polytherapy have higher rates of MS than patients on antipsychotic monotherapy? 4) Which metabolic parameters are considerably disturbed on which antipsychotic users?

METHOD

Subjects

This study was conducted in three different centers; Outpatient Clinic of Istanbul Haydarpasa Numune Training and Research Hospital Psychiatry Department, Outpatient Clinic of Kocaeli University Medical Faculty Psychiatry Department and Outpatient Clinic of Kocaeli Derince State Hospital Psychiatry Department between November 2006 and May 2007. 267 patients who met inclusion criteria participated in the study. This study is approved by the human subjects review committee and patients participate after signing a written informed consent form.

Patients who were 1) Having diagnoses of schizophrenia, schizoaffective disorder and bipolar disorder without any other psychiatric comorbidity according to DSM-IV (APA, 1994) 2) Using the same antipsychotic(s) and/or mood stabilizers at least for the last 6 months 3) Using no medication except antipsychotic(s) and/or mood stabilizers in the last 6 months are included to the study.

Assessment

Blood pressure was measured in the sitting position by using sphygmomanometer after 5 minutes resting. Waist circumference was measured in the standing position, midway between the lowest rib and the iliac crest after a modest expiration. Venous blood was taken to assess fasting plasma glucose, HDL and triglyceride levels after an overnight fast of 8-12 hours. Twelve of 267 patients whose laboratory results were not obtained were excluded from the study. The sample of the study was grouped according to most frequently used drugs therefore 13 patients were excluded because of the small sample size (5 patients on quetiapine, 4 patients on amisulpiride, 2 patients on aripiprazole, 2 patients on ziprasidone). Finally 242 patients were taken to assessment. 121 of them were from Istanbul Haydarpasa Numune Training and Research Hospital, 84 of them were from Kocaeli University Faculty of Medicine and 37 of them were from Kocaeli Derince State Hospital.
Statistics

All statistical analyses were performed by using SPSS (statistics package for social sciences) 13.0 programme. First, descriptive statistics were computed and displayed as percentages and means. T-test (independent samples t test) was used for the comparison of the continuous variables, chi-square test was used for the comparison of the categorical variables. Pearson, continuity correction or fisher exact tests were used if required. Statistical significance was accepted as p < 0.05.

RESULTS

The mean age of 242 patients was 35.95 ± 11.68. 123 (50.8%) of them were female, 119 (49.2%) of them were male. The study group consisted of 153 patients with schizophrenia (63.2%) (including 17 patients with schizoaffective disorder), 89 patients with bipolar affective disorder (36.8%). The mean duration of illness was 129.52 ± 101.11 months, the mean duration of treatment (duration from the beginning of the first treatment) was 119.92 ± 101.34 months. The MS prevalence of total sample according to ATP III and IDF definitions was 36% (87 patients) and 50.4% (122 patients) respectively. The MS prevalence of patients with schizophrenia using ATP III and IDF definitions was 39.2% (60 patients) and 55.5% (85 patients) respectively. Twenty-seven patients with bipolar affective disorder (30.3%) met criteria of ATP III for MS, while 37 patients with bipolar affective disorder (41.6%) had MS according to IDF criteria.

The sample was divided into 7 groups in order to examine the relation between different antipsychotics and metabolic processes:

1. Patients on olanzapine treatment (O)
2. Patients on risperidone treatment (R)
3. Patients on clozapine treatment (C)
4. Patients on zuclopentixole treatment (Z)
5. Patients on combined antipsychotic treatment (AA)
6. Patients on both antipsychotic and mood stabilizer treatment (AM)
7. Patients on only mood stabilizer treatment (M).

Number of patients in each medication group, mean dose and mean duration of treatment were shown in Table 2.

Medication groups were compared in terms of mean age, gender and treatment duration. There was no significant difference between groups as shown in Table 3.
The MS prevalence in the different medication groups according to ATP III and IDF criteria was shown in Table 4. MS prevalence according to ATP III has shown in Figure 1 and MS prevalence according to the IDF has shown in Figure 2.

The MS prevalence was highest in the AA group (48.1%) and lowest in the M group (16%) according to ATP III criteria. According to IDF criteria clozapine (C) group had the highest MS prevalence (74%) and mood stabilizer (M) group had the lowest MS prevalence (28%).

When groups were subjected to binary comparison according to ATP III criteria: MS prevalences in combined AP, clozapine and AM groups were higher than M group (Fisher exact test, p = 0.019, p = 0.037, and p = 0.034 respectively). No significant difference was found between other groups.

When groups were subjected to binary comparison according to IDF III criteria: MS prevalence in clozapine group was higher than zuclopentixole, AM and M groups (p = 0.016, p = 0.043, and
<table>
<thead>
<tr>
<th></th>
<th>Ω</th>
<th>Β</th>
<th>Λ</th>
<th>Ζ</th>
<th>ΑΑ</th>
<th>ΑΜ</th>
<th>Μ</th>
<th>STATISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (year)</strong></td>
<td>36.60</td>
<td>37.59</td>
<td>36.70</td>
<td>34.89</td>
<td>38.40</td>
<td>33.62</td>
<td>34.20</td>
<td><strong>p = 0.570</strong> (anova)</td>
</tr>
<tr>
<td>mean ± SD</td>
<td>± 12.94</td>
<td>± 12.30</td>
<td>± 9.84</td>
<td>± 11.45</td>
<td>± 11.59</td>
<td>± 11.55</td>
<td>± 11.15</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Female–Male)</td>
<td>19–22</td>
<td>19–23</td>
<td>11–16</td>
<td>17–20</td>
<td>15–12</td>
<td>26–17</td>
<td>16–9</td>
<td><strong>p = 0.437</strong> (chi-square)</td>
</tr>
<tr>
<td><strong>Total Duration of treatment (month)</strong></td>
<td>115.70</td>
<td>125.40</td>
<td>136.92</td>
<td>122.89</td>
<td>159.92</td>
<td>90.23</td>
<td>102.80</td>
<td><strong>p = 0.141</strong> (anova)</td>
</tr>
<tr>
<td>mean ± SD</td>
<td>± 103.38</td>
<td>± 108.73</td>
<td>± 105.84</td>
<td>± 99.98</td>
<td>± 114.47</td>
<td>± 85.10</td>
<td>± 83.75</td>
<td></td>
</tr>
</tbody>
</table>
The MS Prevalence in Different Medication Groups

<table>
<thead>
<tr>
<th>Medication</th>
<th>Number of Patients</th>
<th>Number of Patients with MS</th>
<th>MS Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ATP III</td>
<td>IDF</td>
</tr>
<tr>
<td>Olanzapine</td>
<td>41</td>
<td>16</td>
<td>22</td>
</tr>
<tr>
<td>Risperidone</td>
<td>42</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>Clozapine</td>
<td>27</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Zuclopentixole</td>
<td>37</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Combined AP</td>
<td>27</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>Antipsychotic + Mood stabilizer</td>
<td>43</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Mood stabilizer</td>
<td>25</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

Figure 1
MS Prevalence According to ATP III (%)

Figure 2
MS Prevalence According to IDF (%)
Comparison of metabolic parameters in medication groups has shown in Table 5. All groups were subjected to binary comparison and statistically significant results ($p < 0.05$) were shown in the last column.

The mean waist circumference was highest in the clozapine group. Considering binary comparison, the mean waist circumference in clozapine group was higher than zuclopentixole and M groups ($p = 0.020$, and $p = 0.028$ respectively). There was no significant difference between other groups.

The mean systolic blood pressure was highest in the clozapine group. It was higher than zuclopentixole and AM groups ($p = 0.009$, and $p = 0.018$ respectively). There was no significant difference between other groups.

The mean diastolic blood pressure was highest in the clozapine group. It was higher than zuclopentixole group ($p = 0.011$). Patients using combined AP had higher mean diastolic blood pressure than patients using zuclopentixole ($p = 0.046$). There was no significant difference between other groups.

The mean HDL level was lowest in the combined AP group, and highest in the M group. The mean HDL levels in patients using M were higher than patients using olanzapine, risperidone, clozapine, zuclopentixole, combined AP and AM ($p = 0.005$, $p = 0.023$, $p = 0.005$, $p = 0.009$, $p < 0.001$, and $p = 0.044$ respectively). There was no significant difference between other groups.

The mean fasting blood glucose level was highest in the clozapine group. Clozapine group had higher mean fasting blood glucose levels than olanzapine, zuclopentixole and M groups ($p = 0.026$, $p = 0.038$, and $p = 0.031$ respectively). There was no significant difference between other groups.

The mean TG level was highest in clozapine group. Clozapine group had higher mean TG levels than olanzapine, risperidone, zuclopentixol and M groups ($p = 0.035$, $p = 0.040$, $p = 0.012$, $p = 0.001$ respectively). Moreover, patients using olanzapine, risperidone, combined AP and AM had higher mean TG levels than patients using M ($p = 0.009$, $p = 0.004$, $p = 0.007$, $p = 0.008$ respectively). There was no significant difference between other groups.

**DISCUSSION**

The MS prevalences of patients with schizophrenia using ATP III and IDF definitions were 39.2% and 55.5% respectively. 30.3% of patients with bipolar affective disorder met MS according to ATP III,
TABLE 5

COMPARISON OF METABOLIC PARAMETERS IN MEDICATION GROUPS

<table>
<thead>
<tr>
<th></th>
<th>O</th>
<th>R</th>
<th>S</th>
<th>Z</th>
<th>AA</th>
<th>AM</th>
<th>M</th>
<th>P &lt; 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist circumference</td>
<td>98.85</td>
<td>97.52</td>
<td>102.07</td>
<td>93.91</td>
<td>98.37</td>
<td>97.37</td>
<td>94.56</td>
<td>C &gt; Z</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>121.09</td>
<td>120.00</td>
<td>125.55</td>
<td>114.32</td>
<td>121.11</td>
<td>116.86</td>
<td>120.40</td>
<td>C &gt; Z</td>
</tr>
<tr>
<td>Diastolic Blood Pressure</td>
<td>± 18.08</td>
<td>± 19.50</td>
<td>± 18.04</td>
<td>± 15.37</td>
<td>± 17.83</td>
<td>± 12.44</td>
<td>± 16.70</td>
<td>C &gt; AM</td>
</tr>
<tr>
<td>HDL&lt;sup&gt;a&lt;/sup&gt;</td>
<td>43.36</td>
<td>44.28</td>
<td>42.92</td>
<td>43.40</td>
<td>40.25</td>
<td>45.04</td>
<td>52.00</td>
<td>M &gt; O M &gt; R</td>
</tr>
<tr>
<td>FBG&lt;sup&gt;b&lt;/sup&gt;</td>
<td>99.73</td>
<td>103.50</td>
<td>111.25</td>
<td>100.21</td>
<td>105.85</td>
<td>100.30</td>
<td>96.68</td>
<td>M &gt; C M &gt; Z M &gt; AA M &gt; AM</td>
</tr>
<tr>
<td>TG&lt;sup&gt;c&lt;/sup&gt;</td>
<td>136.26</td>
<td>139.26</td>
<td>191.66</td>
<td>116.27</td>
<td>169.92</td>
<td>147.74</td>
<td>91.40</td>
<td>C &gt; O C &gt; R C &gt; Z C &gt; M</td>
</tr>
<tr>
<td></td>
<td>± 77.97</td>
<td>± 73.61</td>
<td>± 134.02</td>
<td>± 99.01</td>
<td>± 133.65</td>
<td>± 98.86</td>
<td>± 38.14</td>
<td>O &gt; M R &gt; M AA &gt; M AM &gt; M</td>
</tr>
</tbody>
</table>

<sup>a</sup>Fasting high-density lipoproteins, <sup>b</sup>Fasting blood glucose, <sup>c</sup>Fasting triglycerides
while 41.6% of patients met MS according to IDF. These rates are compatible with other studies in the literature in general. However, MS prevalence in schizophrenia according to IDF criteria was higher than other studies. This result may be related with exclusion of some antipsychotic groups like quetiapine, ziprasidone and aripirazole, which are thought to be less related with MS.7

The main focus of this study is the comparison of MS prevalence in different antipsychotic groups. Patients using combined AP had the highest MS prevalence according to ATP III criteria (48.1%). Correll et al.,15 reported that patients using combined AP have a MS prevalence of 50%, while patients on antipsychotic monotherapy have 34.3%. Consistent with our study, this data indicates that antipsychotic polytherapy is related with increased metabolic risks. Consistent with the literature another finding of this study is that patients on clozapine and olanzapine therapy have high MS rates according to ATP III criteria.15 MS prevalences in combined AP, clozapine and AM groups were higher than M group according to ATP III criteria. Moreover, the lowest MS prevalence was found on M group, points the relation between antipsychotics and MS. Similarly, another study by Correll et al.21 found that mood stabilizers were not associated with MS suggesting a shared susceptibility to antipsychotic-related metabolic dysregulations in bipolar disorder and schizophrenia patients.

The findings that the MS prevalence in zuclopentixole group is lower (though it is not significant) than all the atypical antipsychotics and is not significantly higher than M group suggest that atypical antipsychotics may have higher risk for MS than typical antipsychotics. If MS prevalence is evaluated by IDF criteria, clozapine group has strikingly high MS prevalence. This result may be related with patients who were under threshold waist circumference and fasting blood glucose criterias of ATP III, because the mean waist circumference and fasting blood glucose levels were relatively high in clozapine group. MS prevalence in combined AP, risperidone and olanzapine groups are also high and almost 1 of 2 patients is diagnosed MS according to IDF in these groups. Significantly higher MS prevalence in clozapine group compared to zuclopentixole group and lower MS prevalence in zuclopentixole group compared to other atypical antipsychotic groups (though it is not significant) point typical antipsychotics should be less guilty compared to atypicals for MS.

Waist circumference indicates central adiposity. Kato et al. stressed that the relation of MS with central adiposity is more powerful than obesity (body mass index). Measurement of waist circumference alone is an important indicator for MS.22 The mean waist circumference in clozapine group was higher than zuclopentixole and M groups.
data suggests that clozapine treatment is more related with increased central adiposity.

Both systolic and diastolic blood pressures were highest in clozapine group, while lowest in zuclopentixole group. Differences of mean blood pressure levels in these groups were also statistically significant. Patients using combined AP had higher mean diastolic blood pressure than patients using zuclopentixole. These data seem to suggest that patients using clozapine and combined AP have higher risk for hypertension.

Almeras et al. reported that after 6 months trial of risperdone or olanzapine treatment, patients on olanzapine had lower HDL levels. In our study, HDL levels in all groups were lower than M group. The findings that lowest mean HDL level was in combined AP group and highest HDL level was in M group suggest the negative effect of antipsychotics on HDL.

Lower blood glucose and insulin levels in patients using typical antipsychotics compared to atypical antipsychotics were reported in several studies. One study observed that patients using olanzapine, clozapine and haloperidol have significantly increased blood glucose levels, although patients using risperidone and fluphenazine have no significant change in blood glucose levels. Another study comparing atypical antipsychotics on means of causing MS and diabetes indicated that olanzapine and clozapine had highest risk, risperidone and quetiapine had intermediate risk and ziprasidone and aripiprazole had lowest risk for MS and diabetes. A study by Leslie et al. suggesting highest diabetes risk in olanzapine and clozapine reported that diabetes risk in risperidone and quetiapine was not higher than typical antipsychotics. In our study, higher mean fasting blood glucose levels in patients treated with clozapine was striking and these levels were higher than in patients treated with olanzapine, zuclopentixole and mood stabilizers. Contrary to other studies olanzapine group were not distinctly hyperglisemic.

High triglyceride levels increase risk for coronary artery and cerebrovascular diseases. Patients treated with clozapine have significantly increased triglyceride levels than patients treated with typical antipsychotics. Leptine and triglyceride levels increased more in patients treated with clozapine and olanzapine than patients treated with quetiapine and especially risperidone. Tandon and colleagues reported that the risk of atypical antipsychotics causing hyperlipidemia are respectively clozapine, olanzapine, quetiapine = risperidone, ziprasidone = aripiprazole from highest to lowest. In our study, clozapine group had higher mean TG levels than olanzapine, risperidone, zuclopentixol and M groups. Moreover, TG levels were higher in patients treated with olanzapine, risperidone, combined AP and AM than patients treated
with M. These findings suggest that clozapine has highest risk for increased TG levels, followed by other atypicals and combined AP while zuclopentixole and M has lower risk.

**CONCLUSION**

The data obtained from this study is summarized in Table 6. As a result; Metabolic risk with antipsychotics is found to be highest in clozapine group, followed by combined AP. Olanzapine and risperidone have intermediate risk, while zuclopentixole has lowest.

The results of our study need to be interpreted within the limitations of its cross-sectional design, moderate sample size, lack of a homogenic disorder group, lack of lifestyle-related factors. Follow up studies from the first episode patients on a homogenous disorder group would give more reliable information about the antipsychotics and metabolic syndrome relations.

**REFERENCES**

