Management Recommendations for Metabolic Complications Associated with Second Generation Antipsychotic Use in Children and Youth

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Abstract

Background: Second generation antipsychotics (SGAs) are commonly associated with metabolic complications. These medications are being used more frequently for the treatment of mental health disorders in children, which has stimulated the need for creating formal guidelines on monitoring their safety and effectiveness. Previous guidelines have been developed for monitoring for metabolic and neurological complications. In order to assist practitioners who perform these monitoring procedures, we have created a complementary set of treatment recommendations if abnormal measurements or results are encountered.

Objective: To create evidence-based recommendations to assist in managing metabolic complications in children being treated with second generation antipsychotics.

Methods: A systematic review of the literature on metabolic complications of second generation antipsychotic medications in children was conducted. Members of the consensus group evaluated the information gathered from the systematic review of the literature and used a nominal group process to come to consensus on treatment recommendations. Wherever possible, references were made to existing guidelines on the evaluation and treatment of metabolic abnormalities in children.

Results: Evidence-based recommendations are presented to assist in managing metabolic complications, including weight gain, increased waist circumference, elevation in cholesterol, triglycerides and glucose, liver function tests, abnormal thyroid studies, and elevation in prolactin.

Conclusion: The use of SGAs requires proper monitoring procedures. This treatment guideline provides guidance to clinicians on clinical management of metabolic complications if they occur.

Background

Metabolic complications of second generation antipsychotics are a common and unfortunate consequence of therapy. The rising use of these medications in Canada and internationally for the treatment of mental health disorders in children has stimulated the creation of formal guidelines on monitoring their safety and effectiveness. The CAMESA guideline group has made evidence-based recommendations on monitoring for metabolic and neurological complications. In order to assist practitioners who perform these monitoring procedures, we have created a complementary set of treatment recommendations if abnormal measurements or results are encountered.
Recommendations if abnormal measurements or results are encountered.

The purpose of this article is to provide guidance to clinicians on the appropriate course of action to follow when abnormal metabolic results are detected over the course of screening examinations. Abnormal values for each parameter are specified, and recommendations on further investigations, repeat testing, and management are listed. The target users of these guidelines are prescribers of antipsychotic medications for children and adolescents, which include psychiatrists, pediatricians, neurologists, and family physicians.

**Methods**

The following metabolic complication treatment recommendations are based on the assumption that the clinician has completed an appropriate diagnostic assessment and that treatment with a second generation antipsychotic medication is indicated. This guideline is intended to assist in managing metabolic complications in situations where the decision to treat with a second generation antipsychotic has already been made by the clinician based on an assessment of the potential risks and benefits for the patient. It is beyond the scope of the article to provide guidance as to whether a second generation antipsychotic should be used as a treatment method.

The CAMESA guideline group did not receive any industry sponsorship and were able to independently develop this manuscript with no restrictions of any kind. Recommendations were created by incorporating the results of a systematic review of the literature on metabolic complications of second generation antipsychotic medications in children (see monitoring guideline for detailed discussion of search methods and knowledge synthesis) with a consensus group process involving experts in the fields of endocrinology, cardiology, nephrology, psychiatry, neurology and paediatrics. Members of the consensus group evaluated the information gathered from the systematic review of the literature and used a nominal group process to come to consensus on treatment recommendations. A nominal group process is a method of small group discussion in which information is gathered by asking individuals to respond to questions posed by a moderator, and then having participants prioritize the suggestions of all group members. This process allows all group participants to contribute to the prioritization of recommendations. Whenever possible, we have made references to existing guidelines on the evaluation and treatment of metabolic abnormalities in children. Prior to the consensus group process, individual interviews were conducted with community paediatricians, psychiatrists, and family practitioners as a needs assessment. The need for formal treatment recommendations was identified, and preferences on format were sought. This information was incorporated into the development of these guidelines. Upon completion, this guideline was externally reviewed by the Canadian Academy of Child and Adolescent Psychiatry and the Canadian Pediatric Society.

The level of evidence (LOE) associated with treatment recommendations is provided. Randomized controlled trials are considered “high” levels of evidence, observational studies are “low”, and any other evidence (retrospective study, case series, or case report) are “very low”. Recommendations have been graded using a classification scheme based on the GRADE system (Brozek, Akl, Alonso-Coello, & al., 2009; Brozek, Akl, Alonso-Coello, Lang, et al., 2009) (Table 1). As with many other paediatric conditions, there is often a lack of large randomized, controlled trials on which to make evidence-based recommendations. Therefore, expert consensus recommendations can still be important even in the absence of strong evidence. Recommendations are listed in the order by which prescribers should pursue them.

**Recommendations**

**MINIMIZING METABOLIC COMPLICATIONS**

*Treatment recommendations for minimizing weight gain:*

1. **Lifestyle intervention**

   Since second generation antipsychotic medication use in children and youth is associated with weight gain and resultant metabolic complications, it is strongly recommended that patients receive counselling (nutrition, lifestyle and exercise) at the initiation of therapy regardless of baseline body mass index. This is particularly important in a child who is overweight or obese prior to treatment with a second generation antipsychotic medication (Grade 3).

2. **Re-evaluate use of antipsychotic medication to minimize weight gain (Grade 3):**
   a. Can the medication be stopped?

      Strong consideration should be made to stopping the medication if severe metabolic side effects are encountered. In placebo discontinuation studies, discontinuation of the antipsychotic medication can result in improvement of weight (Lindsay, Leone, & Aman, 2004; Reyes, Buitelaar, Toren, Augustyns, & Eerdekens, 2006).

   b. Is the lowest effective dose of medication being used?

      Higher doses of both risperidone (LOE high) (Haas et al., 2009) and olanzapine (LOE low) (Correll et al., 2009) have been associated with greater weight gain and an increased likelihood of metabolic abnormalities in children.
c. Can the antipsychotic medication be switched to a different antipsychotic?

Weight gain is the highest with olanzapine (LOE high) (Correll et al., 2009) and clozapine (LOE high) (Kumra et al., 2008), and the risk of high cholesterol, triglycerides and fasting blood sugar is greatest with olanzapine (LOE low) (Correll et al., 2009). Could the patient be switched to risperidone or aripiprazole, which are associated with lower amounts of weight gain and lipid abnormality (LOE low) (Correll et al., 2009)? Ziprasidone has been associated with comparatively less weight gain than other atypical antipsychotics in adult patients (LOE high) (Komossa et al., 2009); however, data is lacking in young children. Switching to ziprasidone may be a consideration in older adolescent patients.

d. Is the patient taking any other medications in addition to the antipsychotic which also causes weight gain? If yes, can these medications be stopped, changed, or reduced?

**BODY MASS INDEX (BMI)**

BMI is determined using a height and weight measurement. For proper technique in measuring, please see the Canadian Pediatric Society position statement regarding the use of growth charts (“A health professional’s guide to using growth charts,” 2004). Age and sex-adjusted growth charts and BMI charts are available at [http://www.cdc.gov/growthcharts/clinical_charts.htm#Set1](http://www.cdc.gov/growthcharts/clinical_charts.htm#Set1) (Source: Centers for Disease Control and Prevention).

The Canadian clinical practice guidelines on the management and prevention of obesity in adults and children recommends comprehensive healthy lifestyle intervention as the first line therapy for obese children (Lau et al., 2007). Behavioural lifestyle intervention in children has been shown to be effective in managing obesity (Oude Luttikhuis et al., 2009). Single blind, randomized controlled trials have been done in adults being treated with antipsychotic medication and have shown that cognitive behavioural therapy aimed at healthy lifestyles improves weight loss compared to no cognitive
behavioural therapy (Alvarez-Jimenez et al., 2006; Khazaal et al., 2007; Weber & Wyne, 2006).

Metformin has been used in some small trials of children on antipsychotic medication (Arman, Sadramely, Nadi, & Koleini, 2008; Klein, Cottingham, Sorter, Barton, & Morrison, 2006; Morrison, Cottingham, & Barton, 2002; Shin, Bregman, Breeze, Noyes, & Frazier, 2009). In a double blind, randomized, placebo controlled study, Arman et al. (2008) found that mean weight and BMI improved in patients on risperidone treated with metformin for the first four weeks compared to placebo, but by 12 weeks there was no significant difference. However, Klein et al. (2006) noted an improvement in weight, BMI z-score and insulin sensitivity in patients treated with metformin compared to placebo in a 16 week double blind, randomized controlled study of children on olanzapine, risperidone or quetiapine. In an open label, prospective cohort study of 12 weeks duration, Morrison et al. (2002) found that 15 of 19 patients on various antipsychotic medications lost weight while on metformin. Another open label, prospective cohort study by Shin et al. (2009) of 12 weeks duration did not show weight loss in those on antipsychotic medication treated with metformin, but did demonstrate that overall, the patients did not continue to gain weight. To date, study findings are discordant and are limited by the short duration of follow-up, small subject numbers, and variability in the antipsychotic medication with which the patients were being treated.

Other medications have been used in the management of weight gain associated with antipsychotic use. Maayan (Maayan, Vakhрушева, & Correll, 2010) conducted a systematic review which included 32 studies and 15 different medications: amantadine, dextroamphetamine, d-fenfluramine, famotidine, fluoxetine, fluvoxamine, metformin, nizatidine, orlistat, phenypropanolamine, reboxetine, rosiglitazone, sibutramine, topiramate and metformin plus sibutramine. The total number of patients was small and only five of these demonstrated small weight loss when compared to placebo: metformin (n=334), d-fenfluramine (n=16), sibutramine (n=55), topiramate (n=133) and reboxetine (n=79). This systematic review demonstrated that there is insufficient evidence to support routine clinical usage of these agents.

**Treatment recommendations for abnormal BMI:**

1. **Normal BMI = 5th percentile to 85th percentile**
   **Recommend:** Repeat BMI measurement at next scheduled screen (refer to screening document).

2. **Overweight BMI = ≥85th percentile and <95th percentile**
   **Recommend:** Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).
   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).

3. **Obese BMI = BMI ≥ 95th percentile**
   **Recommend:** Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).
   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).
   Consider metformin in consultation with a specialist (Grade 2B).

**WAIST CIRCUMFERENCE**

Waist circumference percentiles are sex and age-adjusted and vary for different ethnicities. Technique for waist circumference measurement is described by Douketis et al. (Douketis, Paradis, Keller, & Martineau, 2005). Age and sex-adjusted waist circumference percentiles are available at http://www.idf.org/webdata/docs/Mets_definition_children.pdf (Source: International Diabetes Federation).

**Treatment recommendations for abnormal waist circumference:**

1. **Normal waist circumference = 5th percentile to 75th percentile**
   **Recommend:** Repeat waist circumference measurement at next scheduled screen (refer to screening document).

2. **Elevated waist circumference (abdominally overweight) = ≥75th percentile and <90th percentile**
   **Recommend:** Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).
   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).

3. **Elevated waist circumference (abdominally obese) = ≥90th percentile or exceeding the adult cut-off**
   **Recommend:** Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).
   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).
   Consider metformin in consultation with a specialist (Grade 2B).

**BLOOD PRESSURE (BP)**

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) percentiles are sex, age and height percentile-adjusted. Proper technique for blood pressure measurement in children has been published by the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents (“The fourth report on the...

**Treatment recommendations for abnormal BP:**

1. Normal BP = SBP and DBP <90th percentile
   *Recommend:* Repeat BP check at next scheduled screen (refer to screening document).

2. Pre-hypertension = SBP or DBP ≥90th percentile and <95th percentile or BP exceeds 120/80 mmHg

3. Stage 1 Hypertension = SBP and/or DBP 95th to 99th percentile plus 5mmHg
   *Recommend:* Recheck BP reading in one to two weeks or sooner if symptomatic (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004).
   If persistently elevated on two additional occasions, consider specialist consultation (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004).
   Example: For a three year old girl with a height at the 95th percentile, a BP of 110/69 would be at the 95th percentile (from table provided in the Fourth Report (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004)). She would be at stage 1 hypertension with a BP of 115/74 (5 mmHg above the 95th percentile).

4. Stage 2 Hypertension = SBP and/or DBP >99th percentile plus 5mmHg
   *Recommend:* Consult specialist within one week or immediately if patient is symptomatic (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004).
   Example: For a 12 year old boy with a height at the 95th percentile, a BP of 135/91 would be at the 99th percentile (from table provided in the Fourth Report (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004)). He would be at stage 2 hypertension with a BP of 140/96 (5 mmHg above the 99th percentile).

5. Severe hypertension = SBP or DBP >95th percentile plus >20 mmHg and above or symptomatic
   Patients with symptomatic malignant hypertension (sudden, severe hypertension with threat of organ damage) should be referred to the nearest emergency room (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004).
   Example: For a 10 year old girl with a height at the 95th percentile, a BP of 122/80 would be at the 95th percentile (from table provided in the Fourth Report (“The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents,” 2004)). She would have severe hypertension with a BP of >142/100 (>20 mmHg above the 95th percentile).

**FASTING PLASMA GLUCOSE (FPG) & INSULIN**

The following recommendations are based on the Canadian Diabetes Association 2008 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

**Treatment recommendations for abnormal FPG & fasting insulin:**

1. Normal FPG = FPG < 6.1 mmol/L
   *Recommend:* Repeat FPG at next scheduled screen (refer to screening document).
   If the fasting insulin is above the upper limit of normal for the assay being used, consider oral glucose tolerance test (OGTT) and specialist consultation (Grade 3).
   For those individuals with a FPG value of 5.6 - 6.0 mmol/L, consideration should be given to performing an OGTT (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

2. Impaired FPG = FPG 6.1 - 6.9 mmol/L
   *Recommend:* Consider OGTT and specialist consultation if abnormal (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).
Consider metformin in consultation with a specialist (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

3. Abnormal FPG (Diabetes) = FPG ≥ 7 mmol/L
   Recommend: Consult with specialist for the management of diabetes (Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, 2008).

**FASTING LIPID PROFILE**

Normal lipid levels vary by sex and age (Daniels & Greer, 2008) and several clinical management guidelines have been published on the management of dyslipidemia in children (Daniels & Greer, 2008; Kavey et al., 2006; McCrindle et al., 2007). The following recommendations are based on the guidelines by McCrindle (McCrindle, in press).

**Treatment recommendations for abnormal fasting lipid profile:**

**Low Density Lipoprotein (LDL)**

1. Normal LDL < 3.35 mmol/L (McCrindle, in press).
   Recommend: Repeat LDL measurement at next scheduled screen (refer to screening document).

2. Abnormal LDL ≥ 3.35 mmol/L or a non-HDL cholesterol (total cholesterol minus HDL) ≥ 3.75 mmol/L (McCrindle, in press).
   Recommend: Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).

   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).

3. Elevated LDL ≥ 4.15 mmol/L despite aggressive lifestyle/diet/exercise modification as above for 3-6 months (McCrindle, in press).
   Recommend: Consider consultation with specialist for possible medical therapy (McCrindle, in press).

**High Density Lipoprotein (HDL)**

1. Normal HDL ≥ 1.05 mmol/L (McCrindle, in press).
   Recommend: Repeat HDL measurement at next scheduled screen (refer to screening document).

2. Abnormal HDL <1.05 mmol/L (McCrindle, in press).
   Recommend: Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).

   Consider cognitive/behavioral lifestyle intervention aimed at weight loss (Grade 1B).

**Triglycerides (TG)**

1. Normal TG < 1.5 mmol/L (McCrindle, in press).
   Recommend: Repeat TG measurement at next scheduled screen (refer to screening document).

2. Abnormal TG ≥ 1.5 mmol/L (McCrindle, in press).
   Recommend: Re-evaluate use of antipsychotic medication to minimize weight (Grade 3).

   Consider cognitive behavioral lifestyle intervention aimed at weight loss (Grade 1B).

   Consider consultation with specialist if TG ≥ 5 mmol/L for possible medical therapy (McCrindle, in press).

**LIVER FUNCTION**

Due to the lack of evidence, the following recommendations are based on expert consensus opinion.

**Treatment recommendations for abnormal liver function tests:**

1. Normal AST/ALT
   Recommend: Repeat AST/ALT measurement at next scheduled screen (refer to screening document).

2. Abnormal AST/ALT
   Recommend: Consider repeating AST/ALT (Grade 3).

   Consider specialist consultation for further investigation and management (Grade 3).

**THYROID STIMULATING HORMONE**

Thyroid stimulating hormone measurements have been recommended for children and youth taking quetiapine. Due to the lack of evidence, the following recommendations are based on expert consensus opinion.

**Treatment recommendations for abnormal TSH:**

1. Normal TSH
   Recommend: Repeat TSH measurement at next scheduled screen (refer to screening document).

2. Abnormal TSH
   Recommend: Consider assessment of free thyroxine level (Grade 3).

   Consider specialist consultation for further investigation and management (Grade 3).

**PROLACTIN**

Elevations in prolactin may be associated with signs and symptoms such as gynecomastia, galactorrhea, infertility,
Treatment recommendations for abnormal prolactin:

1. Normal prolactin
Recommend: Repeat prolactin measurement at next scheduled screen (refer to screening document).

2. Elevated prolactin
Recommend: Re-evaluate use of antipsychotic medication (Grade 3):
   a. Is the lowest effective dose of the antipsychotic being used? There is evidence to support that higher doses of both risperidone (LOE high) (Kleinberg, Davis, de Coster, Van Baelen, & Brecher, 1999) and olanzapine (LOE low) (Alfaro et al., 2002) cause more prolactin elevation and prolactin-related side effects in comparison to lower doses.
   b. Can the antipsychotic medication be switched to a prolactin-sparing agent? Risperidone is the second generation antipsychotic with the greatest effect on prolactin (LOE high), while aripiprazole, quetiapine and clozapine do not elevate prolactin (LOE high) (Haddad & Wieck, 2004; Roke, van Harten, Boot, & Buitelaar, 2009). Switching to a prolactin-sparing agent results in return to normal levels of prolactin within weeks (LOE low) (Lee, Kim, & Park, 2006).
   c. If continued treatment with the current antipsychotic medication is essential for the patient’s psychiatric illness, consult with a specialist regarding further management of the hyperprolactinemia.
   d. If clinical concerns, consider specialist consultation for further investigation regarding other causes of hyperprolactinemia and/or amenorrhea.

3. Prolactin elevation and hyperprolactinemia
Recommend: Close monitoring and intervention recommended. Risperidone and clozapine do not elevate prolactin (LOE high) (Kleinberg, Davis, de Coster, Van Baelen, & Brecher, 1999) and olanzapine (LOE low) (Alfaro et al., 2002). Switching to a prolactin-sparing agent results in return to normal levels of prolactin within weeks (LOE low) (Lee, Kim, & Park, 2006).

4. Significant prolactin elevation
Recommend: Close monitoring and intervention recommended. Close monitoring of prolactin elevation and hyperprolactinemia. Risperidone and clozapine do not elevate prolactin (LOE high) (Kleinberg, Davis, de Coster, Van Baelen, & Brecher, 1999) and olanzapine (LOE low) (Alfaro et al., 2002). Switching to a prolactin-sparing agent results in return to normal levels of prolactin within weeks (LOE low) (Lee, Kim, & Park, 2006).

Conclusion
These treatment recommendations have been formulated to advise practitioners of an appropriate course of action if metabolic or other laboratory abnormalities are encountered over the course of screening activities related to second generation antipsychotic use. Practitioners should incorporate these recommendations with their clinical judgement, as the individual and unique nature of patient and drug related complications cannot be ignored. As further long term data becomes available, revisions to these recommendations may be required. It is our hope that the recommendations made will allow practitioners to feel more confident about their monitoring procedures, and more prepared to act if adverse events occur.

Acknowledgements / Conflicts of Interest
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References
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