



Adam Telner



Alan Gervais

One of the authors, an endocrinologist, was experiencing frustration in managing patients with metabolic syndrome because the various parameters of this condition that were followed did not show major changes. It was thought that a multidisciplinary program might provide benefit to patients with metabolic syndrome. *Pour l'un des auteurs, un endocrinologue, le traitement des patients atteints du syndrome métabolique était source de frustration, à cause du manque d'améliorations notables observées dans les divers paramètres qui caractérisent cet état. Nous avons pensé qu'un programme multidisciplinaire pourrait être bénéfique aux patients atteints de ce syndrome.*

Outcomes of a multidisciplinary approach to the management of the metabolic syndrome

Adam Telner, MDCM, MSc, FRCPC, FACP; Alan Gervais, BSP; Stephanie Amos, PhD

Abstract

Background: Patients with the metabolic syndrome (determined by NCEP ATP III criteria) are at increased risk for the development of diabetes, cardiovascular disease, and cancer.

Objectives: We sought to determine whether treating patients at a dedicated community-based clinic using a multidisciplinary program would result in positive changes in predetermined clinical indicators of the metabolic syndrome.

Methods: Patients were referred to the clinic by either family physicians or specialists. They were seen individually by a health care team consisting of a registered dietitian, a registered nurse, a pharmacist, and an endocrinologist. Patients were counselled with regard to lifestyle changes and pharmacotherapy in order to achieve targets for glucose, lipids, blood pressure, and weight. Patients remained on the program for a maximum of 6 months.

Results: There were statistically significant changes for the first 76 patients who completed at least 4 of 6 monthly visits. The following parameters decreased: waist circumference 122.4 to 117.9 cm ($p \leq 0.001$), systolic blood pressure 140.8 to 130.6 mmHg ($p \leq 0.001$), diastolic blood pressure 79.2 to 74.0 mmHg ($p \leq 0.001$), fasting blood glucose 9.0 to 8.1 mmol/L ($p \leq 0.001$), triglycerides 2.5 to 2.0 mmol/L ($p \leq 0.003$), LDL cholesterol 2.6 to 2.2 mmol/L ($p \leq 0.001$), TC/HDL ratio 4.5 to 3.9 ($p \leq 0.001$), BMI 37.4 to 35.8 kg/m² ($p \leq 0.001$), and HbA1C 7.0 to 6.7% ($p \leq 0.004$). There was no change in HDL cholesterol.

Conclusion: Our study demonstrates a significant improvement in most parameters of the metabolic syndrome in patients who attended a dedicated 6-month, community-based, multidisciplinary program. *Can Pharm J* 2008;141: 42-47.

Background

The metabolic syndrome has been defined according to criteria established by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) in the US^{1,2} and by the World Health Organization.^{2,3} The ATP III defines the metabolic syndrome as a condition that meets any 3 of the following 5 criteria: 1) waist circumference >102 cm in males and >88

cm in females; 2) blood pressure >130/85 mmHg; 3) triglycerides >1.77 mmol/L; 4) high-density lipoprotein (HDL) cholesterol <1.0 mmol/L in males and <1.3 mmol/L in females; and 5) fasting blood glucose >6.1 mmol/L.

Patients with the metabolic syndrome are at increased risk for the development of diabetes, cardiovascular disease, and cancer.^{2,4,5} In general, treatment of patients with the syndrome has been

less than optimal, possibly due to a lack of recognition of the syndrome and a lack of time to deal with it, or a less than full understanding of the implications the syndrome has for patients and the health care system.

Management of the conditions associated with the metabolic syndrome includes lifestyle measures and pharmacologic therapy.⁴ In 2004, a literature search failed to provide any published reports on multidisciplinary approaches to the treatment of metabolic syndrome, although 3 articles recommended such an approach.⁶⁻⁸

The purpose of this article is to describe a multidisciplinary approach to the treatment of the metabolic syndrome and the outcomes achieved using a dedicated 6-month, community-based, multidisciplinary program.

Method

The multidisciplinary Carling Metabolic Syndrome Clinic (CMSC) was established in Ottawa in January 2004. Letters of introduction were sent to family physicians and specialists in the Ottawa area informing them of this new program. Patients were referred to this clinic by their family physician or specialist.

A preadmission screening appointment was made with the endocrinologist, at which time a laboratory requisition for blood work was given to the patient. This laboratory data assisted the

endocrinologist with the diagnosis of the metabolic syndrome and also provided baseline data. Other relevant laboratory data, including low-density lipoprotein (LDL) cholesterol, and glycosylated hemoglobin (HbA1C), although not used in the diagnosis of the metabolic syndrome, were also collected. The patient's weight, waist circumference, height, and blood pressure were measured by the registered nurse and entered into the database.

To be eligible, patients had to have a diagnosis of metabolic syndrome and be willing to participate in 6 months of the program. Some patients were offered only 3 months of the program, because initially it was not known what duration was necessary to achieve outcomes.

Patients diagnosed with the metabolic syndrome were seen individually in the CMSC by a health care team consisting of a registered dietitian, a registered nurse, a pharmacist, and an

Key points

- Patients with metabolic syndrome are at increased risk for the development of diabetes and cardiovascular disease. Most people with this syndrome have insulin resistance, which confers increased risk for type 2 diabetes. When diabetes becomes clinically apparent, CVD risk rises sharply.
- Patients diagnosed with the metabolic syndrome attended a community-based, multidisciplinary program, and were educated on healthy lifestyle choices as well as medication changes.
- Multidisciplinary clinics can significantly improve the care delivered to patients with metabolic syndrome.
- These improvements in care lead to benefits in CVD risk profiles that over time may translate to lower rates of CVD.

TABLE 1 Roles of each health care professional

Pharmacist	<ul style="list-style-type: none"> • Review medication history, including natural health products^o • Recommend initiation and/or modification to pharmacologic therapy to achieve targets (after targets not achieved by lifestyle changes) • Discuss benefits of smoking cessation* • Counsel patients on new pharmacologic agents started
Registered nurse	<ul style="list-style-type: none"> • Conduct physical exam (waist circumference, body mass index, blood pressure) • Review cardiovascular risk profile (body morphometry, lipid profile, glycemic status, blood pressure, smoking status) • Discuss benefits of smoking cessation* • Recommend lifestyle changes to increase exercise level if possible*
Dietitian	<ul style="list-style-type: none"> • Recommend lifestyle changes, including diet and exercise*
Endocrinologist [†]	<ul style="list-style-type: none"> • Review all recommendations made by each health care provider • Meet with the patient and pharmacist at the end of each session to discuss individual treatment plan • Write prescriptions if necessary

*Some roles overlapped.

[†]Team leader.

Funding was provided by unrestricted grants from 12 pharmaceutical companies. In addition, the patients paid a nominal fee (to cover 10% of their program costs). It was felt that charging a fee would help to ensure patient compliance in terms of ongoing attendance in the program.

endocrinologist. Before the first 1-hour session, patients were given a questionnaire to complete, requesting their demographic information. The initial 1-hour visit included an assessment by each health care professional and was mainly dedicated to history-taking and providing the patient with an overview of subsequent visits. However, if necessary, recommendations were also made at this time.

The roles of each health care professional for the subsequent visits are listed in Table 1. Some functions were performed monthly (physical exam by nurse), and some only once in the 6-

month period (assessment of herbal medications by pharmacist). Each of these private monthly sessions involved approximately 20 minutes with each health care professional to follow up on recommendations made during the previous visit and provide direction to help patients continue to achieve their predetermined target values. Patients set goals at each visit. Each member of the team reviewed the goals at each visit and set new ones if needed. Some patients were issued pedometers and kept track of their number of daily steps; many also kept a food diary. A variety of resources were used for education, including materials from the Canadian Diabetes Association and the Heart and Stroke Foundation of Canada. Over the course of their participation, patients were periodically given requisitions for blood work to measure individual outcomes from program participation.

After patients had visited with the dietitian, nurse, and pharmacist, each team member provided a written report on the outcome of the session. Patients then met with the endocrinologist and pharmacist to review the other team members' reports. Team (endocrinologist, pharmacist, nurse, dietitian) rounds were held at the end of each day to review each patient visit and discuss a treatment plan for subsequent visits. Rounds provided the team with an opportunity to emphasize any concerns that might have been identified during the day.

In addition to individual counselling, patients were offered monthly group educational sessions on a range of topics (Table 2). External health care professionals or consultants with experience in these areas gave these 45- to 60-minute presentations.

The referring physician was informed in writing of all changes in the patient's management to promote continuity of care.

The CMSC was set up to treat the metabolic syndrome. It was not visualized as a research project, and therefore a proposal was never submitted to an ethics board for approval. However, verbal consent was obtained from each patient to allow for presentation and/or publication of the outcomes of this initiative.

Results

The demographic data of the 110 patients accepted into the CMSC program are presented in Table 3. These patients were referred by family physicians or specialists between January and August 2004. Of the 90 patients who agreed to participate in the full 6-month program, 76 completed at

TABLE 2 Monthly educational topics

Topic	Presenter
Natural health products	Pharmacy student
Psychological aspects of the metabolic syndrome	Psychologist
Living with diabetes	Diabetes nurse educator
Foot care	Chiropodist
Exercise and the metabolic syndrome	Physiotherapist
Cardiovascular disease and the metabolic syndrome	Representative from the Heart and Stroke Foundation

TABLE 3 Demographic data* (n = 110)

Parameter	Value
Average age, years (range, mean)	53.7 (32–77)
Female	43.6
Diabetes	78.2
Hypertension	80.0
Coronary artery disease	13.6
Smoker	10.0
Excess alcohol [†]	2.7

*Data are self-reported and are % unless otherwise indicated.

[†]Excess alcohol defined as >2 drinks per day in men and >1 drink per day in women.

least 4 months.

The paired-samples *t*-test was used to compare patients' results at their final visit with their baseline measures. The results for the 76 patients are presented in Table 4. Four of the 5 parameters for metabolic syndrome — waist circumference, blood pressure, fasting blood glucose, and triglycerides — were significantly decreased at the final visit ($p \leq 0.001$). There was no change in HDL cholesterol. In addition, LDL cholesterol, total cholesterol/HDL ratio, and HbA1C were all significantly reduced by the final visit.

Discussion

Our results demonstrate significant improvement in all predefined parameters of the metabolic syn-

drome, except for HDL, in patients attending a dedicated 6-month, community-based, multidisciplinary program, and the mean changes in these parameters also had potential clinical implications. For example, reduction in waist circumference (by 4.5 cm at the final visit) would signify a decrease in visceral fat,^{11,12} which is regarded as a major contributor to the metabolic syndrome.^{13,14} The reductions of blood pressure by 10/5 mmHg, HbA1C of 0.3%, and LDL cholesterol by 0.4 mmol/L seen in these 76 patients over the 4- to 6-month period may translate to a decrease in cardiovascular disease of greater than 30% over the coming years.¹⁵⁻¹⁷

The outcomes achieved by this clinic are another example of the benefits of interdisciplinary

TABLE 4 Results for patients who completed at least 4 of 6 visits ($n = 76$)^{*†}

Parameter	Target values	First visit	Final visit [‡]	<i>p</i> -value
Metabolic syndrome ^{1,2}				
Waist circumference, cm	Men: <102 Women: <88	122.4	117.9	≤ 0.001
Systolic BP, mmHg	<130	140.8	130.6	≤ 0.001
Diastolic BP, mmHg	<85	79.2	74.0	≤ 0.001
FBG, mmol/L	<6.2	9.0	8.1	≤ 0.001
HDL cholesterol, mmol/L	Men: >1.0 Women: >1.3	1.1	1.1	NS
Triglycerides, mmol/L	<1.7	2.5	2.0	≤ 0.003
Other ¹⁰				
LDL cholesterol, mmol/L	<2.5	2.6	2.2	≤ 0.001
TC/HDL ratio	<4	4.5	3.9	≤ 0.001
BMI, kg/m ²	10%–15% reduction	37.4	35.8	≤ 0.001
HbA1C, %	<7 (6 if possible)	7.0	6.7	≤ 0.004

BMI = body mass index; BP = blood pressure; FBG = fasting blood glucose; HbA1C = glycosylated hemoglobin; HDL = high-density lipoprotein; LDL = low-density lipoprotein; NS = not significant; TC = total cholesterol.

*Patients had all blood work done at a laboratory that was most convenient for them.

†All values are mean.

‡At 4 or 6 months.

Points clés

- Les patients atteints du syndrome métabolique présentent un risque accru de diabète et de maladies cardiovasculaires. La plupart de ces patients présentent ainsi une insulino-résistance qui a pour effet d'accroître le risque de diabète de type 2. Et lorsque le diabète devient cliniquement décelable, le risque de maladies cardiovasculaires augmente sensiblement.
- Des patients chez qui un diagnostic de syndrome métabolique avait été posé ont participé à un programme multidisciplinaire communautaire, visant notamment à les informer sur les choix à privilégier pour adopter un mode de vie sain et sur la modification de leur pharmacothérapie.
- Les cliniques multidisciplinaires peuvent améliorer sensiblement les soins dispensés aux patients atteints du syndrome métabolique.
- Cette amélioration des soins a pour effet d'améliorer les profils de risque de maladies cardiovasculaires et ceci peut se traduire, au fil des ans, par une diminution de l'incidence de ces maladies.

nary collaboration. There is no doubt that patients benefit from collaboration as the result of improved health outcomes and the ability to be involved in their health care.¹⁸ Locating the CMSC in an office suite that was used solely for the clinic facilitated collaboration by providing access to common records and easier communication between health care providers. Examples of the potential impact of collaboration on patient care that occurred in the clinic include one case in which a patient stated to the nurse that he was suffering from erectile dysfunction; the nurse mentioned this to the pharmacist, who then looked for drug-induced causes. In a second case, the dietitian identified a patient who consumed grapefruit juice and brought this to the pharmacist's attention. The

pharmacist was then able to look for potential interactions between grapefruit juice and the patient's medications.

The format of the CMSC has been restructured to increase accessibility and decrease operating costs, while maintaining the multidisciplinary approach. For example, the registration fee has been waived to allow patients who previously could not afford such a program to have access to the clinic, but patients are now paying for personal dietary consultations, since many insurance plans reimburse patients for such consults. At the time that these patients were seen, consultation with community non-physician health care pro-

Resources

- The Carling Metabolic Syndrome Clinic — www.metabolicclinic.com
- Canadian Diabetes Association — www.diabetes.ca
- Heart and Stroke Foundation — www.heartandstroke.ca
- Gervais A. Metabolic syndrome. *Can Pharm J* 2005;138(2):49.
- Gervais A. Treatment of metabolic syndrome. *Can Pharm J* 2005 138(2):50.

professionals was not reimbursed provincially and therefore limited the generalizability of this program to comparable hospital outpatient clinics.

Each health care professional made many recommendations that resulted in changes during the 6-month program, but this information was not captured in our statistics. For example, many patients progressed very well with lifestyle changes only, and as a result the pharmacist was able to recommend that they either decrease their dose of antihypertensive medication or discontinue taking it altogether. Our ongoing program is now capturing data on all interventions.

Although our program produced statistically significant improvements in all of the predetermined parameters of the metabolic syndrome except HDL, our results have several limitations. The small number of patients ($n = 76$) and the short study period (4 to 6 months) restrict us from assessing whether a long-term multidisciplinary approach to the management of patients with metabolic syndrome will continue to maintain target values.

The program was initially developed as a clinic pilot project and did not include a control or comparison group. Also, data are limited to surrogate outcomes rather than clinically significant or hard outcomes, such as decreases in cardiovascular events and hospitalizations.

Despite the fact that all patients were referred and therefore were already being treated for the metabolic syndrome, this clinic still made significant improvements in predetermined parameters. Although these patients may have previously had contact with a physician, a registered nurse, a dietitian, and a pharmacist in the community, our results show that a coordinated multidisciplinary approach produced improved patient health outcomes.

This clinic is unique for many reasons. It provides an opportunity for patient education on healthy lifestyle choices. Group educational sessions and individual discussions helped to involve the patient in life-long modification of acquired habits, such as excessive caloric intake and lack of regular exercise.⁷ Adherence to medication consumption should improve as patients continue to be followed and counselled on a regular basis.

Conclusion

Multidisciplinary clinics can significantly improve the care delivered to patients with metabolic syndrome. Based on the results of this 6-month pilot project, the CMSC has now evolved to become an ongoing program with follow-up as required. Similar clinics must be able to measure

outcomes and provide services in the most cost-effective format. The prevalence of metabolic syndrome in our community dictates that novel

methods of preventing this syndrome as well as recruiting patients must be developed in order to reach as many of the population as possible. ■

From the Carling Metabolic Syndrome Clinic, Ottawa, Ontario. Dr. Telner and Mr. Gervais recently won the Commitment to Care and Service Award for best physician/pharmacist team. Contact atelner@rogers.com.

References

1. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), final report. *Circulation* 2002;106:3143-421.
2. Grundy SM, Brewer HB Jr, Cleeman JI, et al; American Heart Association, National Heart, Lung, and Blood Institute. Definition of metabolic syndrome: Report of the National Heart, Lung, and Blood Institute/American Heart Association conference on scientific issues related to definition. *Circulation* 2004;109:433-8.
3. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus: provisional report of a WHO consultation. *Diabet Med* 1998;15:539-53.
4. Grundy SM, Cleeman JI, Merz CN, et al; Coordinating Committee of the National Cholesterol Education Program. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *Arterioscler Thromb Vasc Biol* 2004;24:e149-61.
5. Klein B, Klein R, Lee KE. Components of the metabolic syndrome and risk of cardiovascular disease and diabetes in Beaver Dam. *Diabetes Care* 2002;25:1790-4.
6. Boyd DB. Insulin and cancer. *Integr Cancer Ther* 2003;2:315-29.
7. Abate N. Obesity and cardiovascular disease. Pathogenic role of the metabolic syndrome and therapeutic implications. *J Diabetes Complications* 2000;14:154-74.
8. Libby P. Metformin and vascular protection: a cardiologist's view. *Diabetes Metab* 2003;29(4 Pt 2):6S117-20.
9. Gervais A, Crotty K, Telner A. Natural health products and metabolic syndrome. *Can Pharm J* 2005;138:26-7.
10. Canadian Diabetes Association Clinical Practice

- Guidelines Expert Committee. Macrovascular complications, dyslipidemia and hypertension. Canadian Diabetes Association 2003 clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes* 2003;27(suppl 2):S58-65.
11. Lemieux S, Prud'homme D, Bouchard C, et al. A single threshold value of waist girth identifies normal-weight and overweight subjects with excess visceral adipose tissue. *Am J Clin Nutr* 1996;64:685-93.
 12. Pouliot MC, Despres JP, Lemieux S, et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. *Am J Cardiol* 1994;73:460-8.
 13. Ruderman N, Chisholm D, Pi-Sunyer X, et al. The metabolically obese, normal-weight individual revisited. *Diabetes* 1998;47:699-713.
 14. von Eyben FE, Mouritsen E, Holm J, et al. Intra-abdominal obesity and metabolic risk factors: a study of young adults. *Int J Obes Relat Metab Disord* 2003;27:941-9.
 15. 1999 World Health Organization/International Society of Hypertension Guidelines for the Management of Hypertension. Guidelines Subcommittee. *J Hypertens* 1999;17:151-83.
 16. Stratton IM, Adler AI, Neil HA, et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *BMJ* 2000;321:405-12.
 17. Law MR, Wald NJ, Rudnicka AR. Quantifying effect of statins on low density lipoprotein cholesterol, ischaemic heart disease, and stroke: systematic review and meta-analysis. *BMJ* 2003;326:1423.
 18. Collaborative care. *Can Pharm J* 2007;140(suppl 1).