Canadian Adult Obesity Clinical Practice GUIDELINES

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L'ASSOCIATION CANADIENNE des MEDECINS et CHIRURGIENS BARIATRIQUE
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Assessment of People Living with Obesity

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KEY MESSAGES FOR HEALTHCARE PROVIDERS

- Obesity is a chronic, progressive and relapsing disease, characterized by the presence of abnormal or excess adiposity that impairs health and social wellbeing.
- Screening for obesity should be performed regularly by measuring body mass index (BMI) and waist circumference.
- The clinical assessment of obesity should aim to establish the diagnosis and identify the causes and consequences of abnormal or excess adiposity on a patient's physical, mental and functional health.
- Providers participating in the assessment of obesity should focus on establishing values and goals of treatment, identifying which resources and tools may be needed and fostering self-efficacy with the patient in order to achieve long-term success.
- A non-judgmental, stigma-free environment is necessary for an effective assessment of a patient living with obesity.

RECOMMENDATIONS

1. We suggest that healthcare providers involved in screening, assessing and managing people living with obesity use the 5As framework to initiate the discussion by asking for their permission and assessing their readiness to initiate treatment (Level 4, Grade D, Consensus).
2. Healthcare providers can measure height, weight and calculate body mass index (BMI) in all adults (Level 2a, Grade B),[1–9] and measure waist circumference in individuals with a BMI 25–35 kg/m^2 (Level 2b, Grade B).[10–12]
3. We suggest a comprehensive history to identify root causes of weight gain as well as complications of obesity and potential barriers to treatment be included in the assessment (Level 4, Grade D).[13–15]
4. We recommend blood pressure measurement in both arms, fasting glucose or glycated hemoglobin and lipid profile to determine cardiometabolic risk and, where appropriate, ALT to screen for nonalcoholic fatty liver disease in people living with obesity (Level 3, Grade D).[16,17]
5. We suggest providers consider using the Edmonton Obesity Staging System to determine the severity of obesity and to guide clinical decision making (Level 4, Grade D).[18,19]

KEY MESSAGES FOR PEOPLE LIVING WITH OBESITY

- Obesity is a chronic disease characterized by the accumulation of excess body fat that can have a negative impact on your physical and mental health, as well as your overall quality of life.
- To guide you and your clinician on the best obesity treatment options, a clinical evaluation is needed to determine how your weight impacts your health and wellbeing. This may include both a mental health assessment and a physical exam.
- Weight bias and stigma are common in clinical settings and can be detrimental to helping you achieve your health goals. Healthcare providers should conduct their obesity assessment in a sensitive and non-judgmental way.

Introduction

Obesity is a chronic disease that requires a systematic and comprehensive diagnosis, assessment and treatment approach.[20] The objective of an obesity assessment is to gather information to confirm the diagnosis, determine the severity of the disease and related comorbidities, identify triggers and drivers and to guide appropriate management discussions in a non-biased and stigma-free clinical setting.[21] Providers should initiate a discussion with the patient about their values and goals for treatment, facilitate reflection and encourage accountability and self-directed management to promote long-term improvements in health.[15]

This chapter provides an evidence-based approach to assessing obesity in the primary care setting through a structured history, physical exam and clinically appropriate laboratory testing. The authors also discuss clinical tools that allow for easy and efficient use in routine clinical practice.

Definition of obesity

Obesity is a complex chronic disease in which abnormal or excess body fat (adiposity) impairs health, increases the risk of long-term medical complications and reduces lifespan.[22–24] Obesity has traditionally been viewed as a risk factor for a wide range of other health issues. The Canadian Medical Association,[20] however, now considers obesity to be a chronic disease in its own right, similar to type 2 diabetes, hypertension and dyslipidemia (in line with other organizations including Obesity Canada, the American Medical Association,[25] the World Health Organization,[24] the World Obesity Federation and others).[25–27]

Initiating a discussion about obesity management

Primary care providers play an important role in the management of most chronic diseases. However, due to the multitude of demands in primary care and lack of comfort and training, the assessment and management of obesity is not easily undertaken. The initial approach, communication and attitude of the physician during an obesity assessment is a significant determinant to the patient's success.[28,29]

Many patients living with obesity have experienced some form of weight bias in the primary care setting.[30,31] This is due in part to professionals' endorsement of negative attitudes and beliefs about obesity, misinformation about causality and perceptions that patients with obesity may be unmotivated and non-compliant. Many patients feel discriminated against and, as a result, will often avoid seeking treatment and delay preventive care.[32] This can affect their health status, their relationship with professionals and their response to interventions.[33]

We recommend that healthcare providers approach patients with empathy and sensitivity. In addition, it's important to acknowledge the complexity of the disease and the difficulty in sustaining behavioural change as well as avoid stereotypes and oversimplification of the disease.[34] A supportive environment with appropriate equipment (for example, appropriately sized blood pressure cuffs and gowns, armless chairs in waiting rooms, a private room for weigh-ins) and asking for permission to weigh patients can help foster patient comfort and dignity. Stigmatization of patients leads to worsened outcomes and promotes disordered eating, increased rates of depression and lower rates of physical activity.[35] This is reviewed in detail in the chapter Reducing Weight Bias in Obesity Management, Practice and Policy.

The use of structured interview formats (such as Obesity Canada's 5As of Obesity Management™) has been proposed to help facilitate discussions about obesity in primary care.[36,37] An adaptation of the 5As' template has been developed by Obesity Canada for use in clinical practice. The main components of this framework include:

1. ASKING for permission to discuss weight and explore readiness;
2. ASSESSING obesity-related risks and root causes of obesity;
3. ADVISING on health risks and treatment options;
4. AGREEING on health outcomes and behavioural goals; and
5. ASSISTING in accessing appropriate resources and providers. [38,39]

Finally, when conducting an obesity assessment and in order to achieve long-term success, it is important to assess each patient's readiness to change, intrinsic motivation and value and goals

when initiating a treatment plan.[40] Personalizing the approach, recognizing patients' strengths and reframing misconceptions about obesity are important key processes that can have a positive impact on the patient's ability to make long-term changes.[15,24] These concepts are reviewed in detail in the Effective Psychological and Behavioural Interventions in Obesity Management chapter.

Screening for obesity

Prior to initiating screening or assessment for obesity, it is important to ask patients' permission to discuss the topic and/or to conduct anthropometric measurements. Evaluation of anthropometric parameters is recommended as a practical screening tool to identify patients with increased adiposity in whom more intensive assessments may be indicated.[41] Moreover, performing regular anthropometric screening can identify patients at risk of developing obesity in whom awareness of their risk and implementation of preventive measures can have a significant positive long-term effect on their health.[42,43] Many anthropometric parameters have been recommended in the screening and assessment of obesity; however, a calculated body mass index (BMI) and measured waist circumference (WC)[44] are the most widely used.

Traditionally, BMI (weight [kg]/height^2 [m]) has been used as a surrogate measure of body fat, and thus an objective parameter to define obesity, both in epidemiological and clinical studies.[12,45–48] Large epidemiological studies have shown that Asian populations may have increased adiposity and cardiometabolic risk at a lower BMI, and alternative cut-off points have been proposed for this patient population.[49–54] Widely accepted classification of obesity based on specific BMI cut-offs are presented in Table 1.

For most populations, the presence of overweight (BMI ≥ 25 kg/m^2) represents an increased risk and requires further evaluation of other anthropometric, hemodynamic and biochemical parameters.[4,55] A BMI ≥ 30 kg/m^2 is associated with an increase in cardiovascular risk factors and all-cause mortality and should be used as a screening criterion to identify obesity in the general population.[4,5] In adults with South-, Southeast- or East Asian ethnicity, the recommended BMI cut-off for overweight should be ≥ 23 kg/m^2. In special populations such as the elderly, very muscular patients and those with extreme tall or short stature, the BMI can be misleading and needs to be interpreted with caution.[9]

Health Canada recommends the diagnosis of obesity not be based on BMI alone.[56] Nevertheless, given its simplicity, objectivity and reproducibility, BMI continues to be an important measure in epidemiological and population-based surveillance studies. In a clinical setting, BMI at the recommended cut-offs should serve only as a simple screening measure. When used together with other clinical indicators, such as WC and clinical evaluation of cardiometabolic and other obesity-related complications, BMI can help identify individuals who may benefit from obesity management. WC has been independently associated to increase cardiovascular risk; however, it is not a good predictor of visceral adipose tissue on an individual basis.[57] Integration of both BMI and WC in clinical assessment may identify the higher-risk phenotype of obesity better than either BMI or WC alone, particularly in those individuals with lower BMI.[58–60]

Regular assessment of BMI, WC and cardiometabolic risk factors can help identify people at greater risk of developing obesity. Regular assessment should also inform care and allow for increased vigilance avoiding obesogenic medications (see Table 8) and counselling on the avoidance of weight gain during high-risk time periods, such as pregnancy or forced sedentariness due to injury (see Prevention and Harm Reduction of Obesity [Clinical Prevention]).

Box 1: Measuring Body Mass Index

- All anthropometric measurements should be conducted barefoot and in light clothing.
- Weight and height should be measured by trained professionals using standardized techniques and equipment and recorded to the nearest 0.1 kg and 1 cm.
- BMI should be calculated as weight (kg) divided by the square of the body height in metres (kg/m^2).

Table 1: Recommended Classification of BMI[45,53]

Category	BMI (kg/m^2)
Caucasian, Europid and North American ethnicity[45]	
Underweight	< 18.5
Normal (healthy weight)	18.5–24.9
Overweight	25–29.9
Obesity Class I	30–34.9
Obesity Class 2	35–39.9
Obesity Class 3	40–49.9
Obesity Class 4	50–59.9
Obesity Class 5	≥ 60
South-, Southeast- or East Asian ethnicity[53]	
Underweight	< 18.5
Normal range	18.5–22.9
Overweight—At risk	23–24.9
Overweight—Moderate risk	25–29.9
Overweight—Severe risk	≥ 30

Although BMI is a simple, objective and reproducible measure, it has certain limitations that need to be recognized by clinicians using these tools.[36,37]

- BMI is not a direct measure of body fat, cardiovascular risk or health.
- BMI does not indicate body fat distribution.
- BMI does not account for muscle mass (it overestimates body fat in muscular individuals).
- BMI can underestimate body fat in people who have lost muscle mass (sarcopenic obesity).
- BMI does not distinguish between men, women or ethnicity.
- BMI is less accurate in certain populations (e.g., the elderly, people with physical disability, people <18 years of age, people with severe obesity, during pregnancy and in patients with ascites or severe edema).
- BMI over- or underestimates body fat in certain ethnic groups, such as Indigenous Peoples, South Asians, Chinese and other populations.

Waist circumference

Considering the limitation of BMI in determining fat composition and distribution as well as the anatomical variations in fat deposition, the use of WC has been recommended as a surrogate measure of abdominal or visceral fat.[61] There is epidemiological evidence to suggest that WC can help identify individuals at increased risk for cardiometabolic disease.[57,62,63] A standardized method for accurately measuring WC is outlined in Box 2. Current recommended WC cut-offs are included in Table 2.

In the United States and Canada, a WC ≥ 102 cm (in men) or ≥ 88 cm (in women) indicates an increased risk of visceral adiposity and of developing cardiometabolic comorbidities. For adults with a predominant South Asian, Southeast Asian or East Asian ethnicity, a lower cut-off for WC (≥ 85 cm in men and ≥ 75 cm in women) is recommended.

Despite its low-tech appeal and significant statistical association with cardiometabolic risk, there are important limitations to the routine use of WC measurement in the clinical setting:

- WC is not a direct measure of visceral fat.
- Considerable training and standardization are required to ensure inter- and intra-reader reproducibility.
- WC is sensitive to abdominal distention due to food or fluid intake, bloating, ascites, pregnancy, etc.

Box 2: Measuring Waist Circumference

1. Remove clothing from the waistline.
2. Stand with feet shoulder width apart (25 to 30 cm or 10 to 12 inches) and a straight back.
3. Palpate the abdomen to locate inferior margin of the last rib at the level of the mid-axillary line.
4. Palpate and identify the crest of the ileum in both sides. Use the area between the thumb and index finger to feel for the hip bone at the level of the mid-axillary line. This is the part of the hip bone at the side of the waist, not at the front of the body.
5. WC should be measured at the end of a normal expiration, midway between the inferior margin of the last rib and the crest of the ileum in a horizontal plane using a stretch-resistant tape that provides a constant 100 g tension and should be recorded to the nearest 1 cm.
6. Have the patient take two normal breaths, and on the exhale of the second breath tighten the tape measure so it is snug but not digging into the skin.

- Varying cut-offs for ethnic populations.
- Less sensitive measure of visceral fat with increasing BMI.
- WC requires further body exposure and can be perceived as an intrusive measurement by some patients.

As with BMI, WC can be used as a simple and practical screening tool to identify individuals at higher risk of cardiometabolic disease. This may be particularly true for individuals who fall below the accepted BMI cut-offs for obesity. A variety of optimal cut-off values have been proposed, depending on ethnicity, measuring technique and outcomes of interest. Most cut-offs range from 65.5 to 101.2 cm for women and 72.5 to 103 cm for men.[63–66] Patients with an increased BMI (< 35 kg/m^2) and an elevated WC are associated with an increased risk of developing cardiometabolic risk factors, such as diabetes mellitus type 2 and hypertension.[67] Those with a BMI > 35 kg/m^2 are likely to be at an increased risk of cardiometabolic risk factors irrespective of their WC.

Integration of anthropometric measurements

Both BMI and WC provide valuable and complementary information in the assessment of obesity and the estimation of cardiometabolic risk. Among individuals with an elevated BMI (< 35 kg/m^2), having an increased WC may imply a greater risk of developing significant

Table 2: Proposed Waist Circumference Cut-Off Points (cm) to Define Increased Abdominal Adiposity by Predominant Ethnicity

Predominant Ethnicity	Increased Abdominal Adiposity/ Cardiovascular Risk		Significant Abdominal Adiposity/ Greater Cardiovascular Risk	
	Women	Men	Women	Men
Caucasian Europid/United States/ Mid-East Mediterranean[68]	80	94	88	102
Latino Central/South American[69]	83	88	90	94
Sub-Saharan African[68]	80	94		
African American	90	80	99	95
African	71.5	76.5	81.5	80.5
Asian	80	85		
Chinese[70]	81	83		
Korean[71]	75	80	85	90
Canadian Aboriginal[72]	80	94		

cardiometabolic outcomes. Furthermore, among patients with a normal BMI, an increase in WC may imply intra-abdominal fat deposition and an increased risk of cardiometabolic disease.[73] These patients may benefit from early intervention to treat and prevent obesity-related complications. Finally, measuring WC in patients with a BMI > 35 kg/m^2 may not change management, but it can provide patients with valuable information regarding the efficacy of their treatment during their long-term follow-up. Some patients can see changes in adipose distribution before a significant change in body weight or BMI.

Assessing the impact of excess or abnormal adiposity on health

The association between the diagnosis of obesity and the development of obesity-related complications is strong but not always linear; therefore, comparable levels of excess adiposity obesity can have different levels of impact on health and quality of life for different patients. Similarly, multiple reports have documented a subgroup of "metabolically healthy" patients with obesity, characterized by the absence of any objective evidence of increased cardiometabolic risk despite having an elevated BMI and waist circumference.[74,75] Despite the absence of concurrent cardiometabolic risk factors, the so-called metabolically healthy patients with obesity should not be considered to be fully medically healthy, as these patients are at increased risk of mortality,[75] and are more likely to suffer other non-metabolic conditions associated with obesity, such as sleep apnea, depression and joint/back pain, among others. Information gathered in the obesity assessment and analyzed using the Edmonton Obesity Staging System (EOSS) [18,19] can help to understand the severity of the disease and guide the intensity of treatment required.

Edmonton Obesity Staging System

Elements of the EOSS have been proposed to guide clinical decisions from the obesity assessment and at each BMI category.[19] Table 3 reviews the proposed clinical staging and its impact on management. EOSS is a measure of the mental, metabolic and physical impact that obesity has had on the patients' health and uses these factors to determine their stage of obesity (from stage 0–4). In population studies, EOSS has been shown to be a better predictor of all-cause mortality when compared to BMI or waist circumference measurements alone.[40]

Table 3: Edmonton Obesity Staging System

Stage	Description	Management
0	No apparent obesity-related risk factors (e.g., blood pressure, serum lipids, fasting glucose, etc. within normal range), no physical symptoms, no psychopathology, no functional limitations and/or impairment of wellbeing	Identification of factors contributing to increased body weight Counselling to prevent further weight gain through behavioural measures, including healthy eating and increased physical activity
1	Presence of obesity-related subclinical risk factors (e.g., borderline hypertension, impaired fasting glucose, elevated liver enzymes, etc.), mild physical symptoms (e.g., dyspnea on moderate exertion, occasional aches and pains, fatigue, etc.), mild psychopathology, mild functional limitations and/or mild impairment of wellbeing	Investigation for other (non-weight-related) risk factors More intense behavioural interventions, including nutrition therapy, exercise and psychological treatments to prevent further weight gain Monitoring of risk factors and health status
2	Presence of established obesity-related chronic disease (e.g., hypertension, type 2 diabetes, sleep apnea, osteoarthritis, reflux disease, poly-cystic ovary syndrome, anxiety disorder, etc.), moderate limitations in activities of daily living and/or wellbeing	Initiation of obesity treatment, including considerations of all psychological interventions, pharmacological and surgical treatment options Close monitoring and management of comorbidities as indicated
3	Established end-organ damage such as myocardial infarction, heart failure, diabetic complications, incapacitating osteoarthritis, significant psycho-pathology, significant functional limitations and/or impairment of wellbeing	More intensive obesity treatment including consideration of all psychological interventions, pharmacological and surgical treatment options Aggressive management of comorbidities as indicated
4	Severe (potentially end-stage) disabilities from obesity-related chronic diseases, severe disabling psychopathology, severe functional limitations and/or severe impairment of wellbeing	Aggressive obesity management as deemed feasible Palliative measures including pain management, occupational therapy and psychosocial support

Adapted from: Sharma AM, Kushner RF. A proposed clinical staging system for obesity. Int J Obes. 2009;33(3):289–295.[19]

Once the diagnosis has been established, the primary goal for the clinical assessment for obesity should be to identify the possible causes leading to weight gain, determine the extent to which weight has affected the patients' health and to systematically look for barriers in their management.[76] Given that obesity is a complex and heterogeneous disease, this is often a daunting task for primary care providers. Using a clinical tool such as the 4Ms framework (Mental health, Mechanical, Metabolic, Monetary health / Milieu) can provide a practical approach for primary care physicians to explore major drivers, barriers and complications of obesity (see Table 4).[77] It can be used to provide a structure to perform an efficient and complete obesity assessment, including the history, physical exam and clinically indicated investigations.

Table 4: Components of the 4Ms Framework for Assessment of Obesity[77]

Category	Complications	Frequency	Investigations	Treatment Notes
Mental Health	Knowledge/cognition	+ + *		
	Expectations	+ + *		
	Self-image	+ + * (F>M)		
	Internalized weight bias	+ + +	This can be accomplished through sensitive questioning/dialogue/motivational interviewing (e.g., "Can you share with me if or how your weight affects your perception of yourself?") or by questionnaire (WBIS). See the chapter Reducing Weight Bias in Obesity Management, Practice and Policy for details.	Unresolved perception of weight bias can have an influence on obesity management. Coping strategies to address internalized weight bias should be incorporated into behavioural interventions, consistent with the principles of cognitive behavioural therapy and acceptance and commitment therapy.
	Mood/anxiety	+ + * (F>M)	PHQ-9, GAD	If starting pharmacotherapy, consider options that do not increase weight (see the chapter Prevention and Harm Reduction of Obesity (Clinical Prevention)
	Addiction	+ + *	Yale Food Addiction Scale	
	Sleep	+ + *		
	Attention	+ + *		
	Personality	+ + *		
Mechanical	Osteoarthritis	+ +	History, X-ray	
	Gout	+ + +	Uric acid level	Avoid steroids if possible
	Sleep apnea	+ + +	STOP BANG sleep apnea questionnaire, Berlin Questionnaire, overnight sleep study	CPAP therapy if indicated
	Plantar fasciitis	+ + *		
	Gastroesophageal reflux	+ +		
	Urinary incontinence	+ + *		
	Intertrigo	+ + *		
	Idiopathic intracranial hypertension (Pseudotumour Cerebri)	+		
	Thrombosis	+		
Metabolic	Type 2 diabetes	+ + +	A1C, fasting glucose	Consider medication options that are weight neutral, promote weight loss
	Hyperlipidemia	+ + +	Total cholesterol, triglycerides, HDL-C	
	Nutritional deficiency	+ + +	25 hydroxy-vitamin D, iron studies, serum B12 level	Vitamin D 1000-3000 units/day, supplement as needed to achieve therapeutic levels
	Gout	+ + +	Uric acid	Avoid prednisone if possible
	Hypertension	+ +	Ensure appropriate cuff size (bladder width 40% of arm circumference, length 80–100% of arm circumference)[54]	DASH diet, consider secondary causes (e.g., sleep apnea, pain) Prioritize medications that affect the renin-angiotensin system, avoid beta blockers as first line

	Endocrine			
	PCOS/hypogonadism	+		
	Infertility	+	Total testosterone, estradiol, prolactin, 17 hydroxyprogesterone, LH/FSH, DHEAS, TSH if clinical suspicion of hypothyroidism	Consider metformin if insulin resistant
	Cardiovascular disease	+ +	ECG, ECHO, treadmill/bicycle/nuclear stress test if indicated and if patient able	
	Left ventricular hypertrophy, atrial fibrillation			
	Chronic venous stasis/ ulcers/thrombophlebitis			
	Stroke, DVT/PE			
	Neurological			
	Pseudotumor cerebri	+	Hx: Headache, pulsatile tinnitus, papilledema	
	Gastrointestinal disease			
	Fatty liver	++/+++		
	Gallstones	+ + +	Liver enzyme elevation, increased liver stiffness (elastography) abdominal ultrasound, FIB-4 score	
	Oncology	+	Routine cancer screening	Patients with obesity are at high risk for certain cancers and are less likely to be screened due to technical issues with diagnostic testing and delays in seeking medical attention.
	Colorectal, gallbladder, pancreatic, breast, renal, uterine, cervical, prostate			
	Skin			
	Acanthosis, skin tags	+ + +		
	Candida	++*		
	Intertrigo	+*		
	Tinea	+*		
	Folliculitis	+*		
Monetary Health/ "Milieu"	Socioeconomic status	+		
	Education			
	Access to food			
	Occupation			
	Disability			
	Clothing			
	Weight loss programs			
	Access to pharmacotherapy			
	Surgery			
	Vitamins			

+	RR 1–2 (rare) but increased risk with obesity
++	RR 2–3 (uncommon) screen if appropriate
+++	RR >3 (common) screen most patients

PHQ-9: Patient Health Questionnaire-9; GAD: generalized anxiety disorder; CPAP: continuous positive airway pressure; PCOS: polycystic ovarian syndrome; LH/FSH: luteinizing hormone/follicle stimulating hormone; DHEAS: dehydroepiandrosterone; TSH: thyroid stimulating hormone; ECG: electrocardiogram; ECHO: echocardiogram; DVT/PE: deep venous thrombosis/pulmonary embolism; FIB-4 : Fibrosis-4, F: Female; M: Male; RR: Relative Risk; *Depending on patient population.

Components of an obesity-centred history

An obesity-centred history should include all parts of a routine clinical interview, such as past medical and surgical history, medications, allergies and social and family history. However, an emphasis should be placed on screening for underlying root causes and consequences of obesity (reviewed in Table 4). Key elements of the history include screening for sleep disorders; physical, sexual and psychological abuse; description of eating patterns; physical activity and screen time; internalized weight bias; mood and anxiety disorders; as well as substance abuse and addiction.[13,14] A thorough history of medications should screen for weight-promoting medications. Consider alternative options where possible. The most common weight-promoting medications are outlined in Table 8. The clinician conducting the assessment should also identify and document the patient's values and goals around treatment and foster insight to help with long-term coping and self-management skills.[15,24] Table 5 reviews some key components which are specific to an obesity-focused interview. Key processes of a personalized obesity assessment in primary care are highlighted in Table 5; these have been shown to have a positive impact on the patient's' ability to foster everyday change and facilitate improvements in their physical, mental and social health.[15,24]

Components of an obesity-centred physical exam

An obesity-centred physical exam should be focused on determining the obesity phenotype, drivers of weight gain and treatment barriers for all patients. The key components of an obesity-centred physical exam are outlined in Table 6. Routine anthropometric measurements should include height, weight, BMI and waist circumference. Blood pressure should be measured with an appropriately sized cuff according to the patient's arm circumference. If a large upper arm size is prohibitive, systolic blood pressure can be measured in the forearm selecting the cuff size (small cuff [20.0–26.0 cm], standard cuff [25.4–40.6 and 25.0–34.0 cm] and large cuff [> 32.0 cm]) according to participant's forearm circumference. For cuff installation in the forearm, position the distal edge of the cuff about 6 cm proximal to the styloid process of the ulna.[78,79] Neck circumference and airway patency are also helpful to estimate the risk of sleep apnea. In addition to a routine cardiorespiratory, a head, neck and gastrointestinal exam should be performed along with a general skin examination to rule out common skin findings (see Table 6). A joint and gait examination is also recommended to assess for barriers in mobility. A cursory endocrine exam includes palpating for an enlarged thyroid gland and screening for signs of Cushing syndrome and polycystic ovarian syndrome. These signs, if present, should prompt further biochemical screening.

Investigations to assess obesity

Diagnostic testing is commonly ordered during the initial assessment of obesity to identify metabolic problems and to tailor therapy. There is no single blood test or diagnostic evaluation that is indicated for all patients with obesity. The specific evaluations performed should be based on the presenting symptoms, the patient's risk factors and index of suspicion. Table 7 reviews some blood and diagnostic testing for clinicians to consider when assessing a patient with obesity. Screening for metabolic syndrome with a HbA1c or fasting blood sugar, total cholesterol, serum triglycerides and HDL level is recommended in most patients.[80] Patients who are at high risk of fatty liver disease, including those with type 2 diabetes or metabolic syndrome, should be screened with an ALT level and an abdominal ultrasound. A referral to gastroenterology/hepatology may be appropriate in patients with persistently elevated liver enzymes (greater than two times the upper limit of normal over six months and/or high FIB-4 scores). The gold standard to diagnose non-alcoholic fatty liver disease is a liver biopsy.[81]

Evaluation of coronary artery disease

Large prospective studies have documented obesity as being an independent predictor of coronary artery disease.[82] This relationship was stronger in younger individuals. Susceptibility to obesity-related cardiovascular complications is not only mediated by overall body fat mass, but is largely dependent upon individual differences in regional body fat distribution.[73,83] Large cohort studies using imaging techniques have identified excess abdominal visceral adipose tissue as a strong predictor in the development of cardiovascular disease over time, independently of total body fat mass.[84] Numerous non-invasive tests can diagnose atherosclerosis or myocardial ischemia, or both. The correct choice depends on local expertise, the relative strengths and weaknesses of each modality and individual patient characteristics, as well as pretest likelihood of coronary artery disease.

Electrocardiogram

Obesity has the potential to impact the ECG in several ways, including displacement of the heart by elevating the diaphragm in the supine position, increasing the cardiac workload and increasing the distance between the heart and the recording electrodes. Besides low QRS voltage and left-ward trend in the axis, other alterations frequently seen are non-specific flattening of the T-waves in the infero-lateral leads (attributed to the horizontal displacement of the heart) and voltage criteria for left atrial abnormality. An increased incidence of false positive criteria for inferior myocardial infarction in individuals living with obesity, due to the elevation of the diaphragm has been reported.[85] Left ventricular hypertrophy is probably underdiagnosed based on the usual ECG criteria in individuals with greater than Class II obesity. Since baseline ECG may be influenced by obesity (false positive for inferior myocardial infarction, microvoltage, non-specific ST-T changes) and patients with obesity may have impaired maximal exercise testing capacity (dyspnea, mechanical limitations, left ventricular diastolic dysfunction), other modalities may be of interest in the evaluation of coronary artery disease in this population. Indeed, due to impaired exercise tolerance because of mechanical and physiological limitations related to stress testing in patients at very

Table 5: Recommended Key Components of an Obesity-Centred Medical History

Interview Component	Details	Implication/Significance /Recommended Actions
Weight history	Document age of onset of obesity and major weight trajectories over time Previous weight loss attempts and response to interventions (including behavioural interventions, medications, endoscopic and surgical interventions) Highest and lowest weight Major life event(s) associated with weight change Current phase of weight (e.g., gaining, losing, stable)	Can help to understand patients weight journey, success/failures of past attempts and causes of weight gain/loss in the past, childhood vs. adult obesity Can help to establish realistic expectations Can help to prevent future weight gain and target behavioural and psychological treatment Can help to make appropriate goals (e.g., weight stabilization if currently gaining weight) Key Processes[15,24] • Show compassion • Real listening (paraphrase and summarize to ensure you understand and validate the patient's thoughts) • Help patients make sense of their story (find root causes, foster insight, find patterns/triggers, identify values/goals, reflect on timeline to acknowledge impact on life in context to weight)
Nutrition history	Assess nutrition literacy Assess energy intake Identify current nutritional restrictions (Celiac disease, allergies)	Is there concern of physiological hunger, emotional eating, mindless eating, knowledge deficit?[86] See the chapter Medical Nutrition Therapy in Obesity Management for details
Physical activity	Current physical activity including time spent in sedentary activities Limitations to activity (e.g., pain, time, motivation) Identify social limiting factor restricting access to increasing physical activity	Help patient to make self-directed activity goals Address limitations independently (e.g., pain management for joint pain, etc.) See the chapter Physical Activity in Obesity Management Key Processes[15,24] • Recognize strengths • Shift beliefs • Reframe misconceptions • Help establish whole-person value goals and functional outcomes instead of weight-based goals
Depression and anxiety screening	Screen for depression and anxiety	Consider referral to psychiatry/psychology
Other mental health issues/drivers	Screen for attention deficit hyperactivity disorder, post-traumatic stress disorder, chronic grief Psychological impact of previous weight journey	Consider referral to psychiatry/psychology Review challenges with body image, self-esteem
Addiction/ dependency	Smoking status Alcohol intake Use of cannabinoids and other psychoactive substances Current or previous abuse of substance Excessive use of caffeine-containing beverages (e.g., sugar sweetened beverages)	Consider referral to psychiatry/psychology

Abuse	Screen for previous and current forms of physical, psychological and sexual abuse	Unresolved history of abuse and current abuse can be a barrier to obesity management and can have an impact on food behaviours and relationship with food Interdisciplinary approach may be required
Sleep history	Number of hours of sleep per night Use of pharmacologic sleeping aids Sleep apnea-hypopnea screening (such as STOP BANG Sleep Apnea Questionnaire)	Poor sleep quality and quantity can be a barrier to obesity management.[87] If positive screening (STOP BANG > 4), consider referral to rule out sleep apnea
Medication history	Review medications that can have a significant impact on weight.[88]	See Table 8 Key processes[15,24] • Make sense of the story • Help establish root causes
Social history	Age, sex, ethnicity, marital status, occupation/work schedule: number of hours per week, night shift work	Eating behaviours in shift workers may require additional consideration when deciding therapeutic options
	Income support, medical coverage, access to exercise facilities	Evaluate patients' access to food options, nutritional education, cooking skills Consider involving a social worker/counsellor in cases where income, medication coverage and resource access may be limited
	Level of functional independence	In patients with decreased independence, consider involving caregivers and decision makers
Family history	History of first-degree relative with overweight/obesity or related complications Overweight and obesity in other household members	Can help determine patients' risk of obesity or related complications Group interventions are more challenging but more likely to be feasible and sustainable in patients exposed to environments where obesity is highly prevalent
Interpersonal assessment	Motivation Confidence Readiness to change Expectations	See the chapter Effective Psychological and Behavioural Interventions in Obesity Management Key Processes[15,24] • Recognize strengths • Shift beliefs (help manage expectations, focus on the whole health of the patient) • Co-construct a new story (context integration, prioritizing goals) • Orient values and plan actions (help establish direction) • Foster reflection (insight, motivation, accountability) • Help internalize core messages (help establish coping skills)

Table 6: Key Components of an Obesity-Centred Physical Exam

Vital signs: blood pressure (appropriately sized cuff), heart rate
Anthropometric measurement: weight, height, waist circumference, BMI
Head and neck • Neck circumference, Mallampati score • Thyroid exam • Cushing's (moon facies, prominent supraclavicular and dorsocervical fat pad) • Polycystic ovary syndrome (acanthosis nigricans, hirsutism, acne)
Cardiorespiratory • Heart rate and rhythm • Signs of heart failure (added heart sounds, pedal edema, pulmonary rales)
Gastrointestinal • Liver span • Umbilical, incisional hernias • Screening for stigmata of chronic liver disease (encephalopathy, ascites, jaundice, palmar erythema, etc.)
Musculoskeletal • Osteoarthritis (Heberden's/Bouchard's nodes, weight-bearing joints) • Gout • Gait exam
Skin • Candida, intertrigo, tinea, skin tags, psoriasis, acanthosis nigricans • Nutritional deficiencies (pallor of conjunctiva, palmar crease rubor, atrophic glossitis, neuropathy)[89] • Abdominal striae (violaceous striae wider than 1 cm)
Lower limbs • Lymphedema (non-painful, pitting edema, typically arms/legs) • Lipedema (often painful fat deposition, non-pitting edema, typically in arms and legs with sparing of the hands and feet) • Venous insufficiency, ulcers, stasis, thrombophlebitis

high BMIs, a perfusion scan may be used instead of exercise testing for evaluating the presence of ischemic heart disease.

Exercise stress test

Standard stress test performance is limited in patients with obesity for a number of factors. ECG modification might limit accurate interpretation. Aerobic capacity is diminished because of pulmonary dysfunction, orthopaedic limitations and left ventricular diastolic dysfunction. Many patients with obesity fail to achieve 80–85% of the age-predicted heart rate needed for diagnostically valid results.[90,91] Standard Bruce and modified ramp protocols achieve valid results in most patients, with patients terminating the test because of fatigue, leg pain or dyspnea.[92] Patients with obesity may also experience mobility, joint and balance issues limiting their ability to use a treadmill. In these patients, the use of a bike ergometer is recommended. Higher systolic and diastolic blood pressures are typically found during the exercise stress test in patients with obesity.[93]

Nuclear imaging techniques

Technetium sestamibi is the marker of choice in patients with obesity because of greater energy emission, which generates better images.[94–96] Weight-based limitations might occur in patients with a body weight above 350 pounds (~160 kg), which might require planar imaging. Newer and more sensitive cameras might eliminate some of these issues, but their use still leads to challenges with table weight and size, given that proper positioning of the patient

is required in order to use this system. Positron emission tomography (PET) computed tomography rubidium has a 91% sensibility and 89% specificity; is faster than sestamibi-SPECT; produces less radiation exposure, better quality images and correction for attenuation; and has a greater degree of diagnostic precision and a reduced need for invasive examinations.[97] The PET rubidium is the nuclear imaging technique of choice for patients with obesity.

Stress echocardiography

Despite some limitations, exercise stress echocardiography is a valid technique for patients with obesity.[98] The feasibility of stress echo, using either physiological stress (treadmill exercise) or pharmacological stress (dobutamine) is excellent in most cases. It is widely available, low cost, radiation free and has no weight limits. Stress echocardiography is highly operator-dependent and can be limited in the presence of poor acoustic windows related to pulmonary disease, obesity and respiratory motion. If severe limitations exist, transesophageal echocardiography with dobutamine might be useful.[99]

Evaluation of other conditions associated with obesity

Women with obesity and symptoms of polycystic ovary syndrome should be screened for LH, FSH, total testosterone, DHEAS, prolactin, TSH and 17 hydroxyprogesterone levels. Other endocrinopathies, including thyroid dysfunction, Cushing's or acromegaly are not routinely recommended unless clinically warranted. We encourage age-appropriate cancer screening for patients with obesity as they are at an increased risk and often have poor outcomes due to lower rates of routine screening and delays in seeking treatment.

Can you have a high BMI and be healthy?

As with most health indicators (e.g., blood pressure, blood glucose, cholesterol), there exists a curvilinear relationship between the amount of body fat and its impact on health. In epidemiological studies the relationship between body fat (or BMI as a surrogate) and health impacts follows a U-shaped curve with health risks progressively increasing at both the lower and higher ends of the BMI spectrum.[100] While there is a statistically significant relationship between increasing BMI and health risks, a given individual can present with virtually no relevant health issues over a wide range of BMI levels.[101,102] Although individuals with an elevated BMI who appear healthy may have a modestly elevated health risk (and a high likelihood of developing complications in the long term),[103] there is currently no evidence to support long-term benefits of intentional weight loss in these individuals. A prudent approach to individuals presenting with an elevated BMI without the presence of overt impairment to health, would be to reinforce health behaviours aimed at preventing further weight gain and reducing the development of relevant complications.

Table 7: Laboratory and Diagnostic Tests to Consider in the Assessment of Patients with Obesity

Consider for most patients

- HbA1c
- Electrolytes renal function tests (creatinine, eGFR)
- Total cholesterol, HDL- and LDL-cholesterol, triglycerides
- Alanine aminotransferase (ALT)
- Age-appropriate cancer screening

Consider only if clinically indicated

- Complete (full) blood count
- Thyroid stimulating hormone/thyroid function tests
- Uric acid
- Assessment of iron (TIBC, % saturation, serum ferritin, serum iron)
- Vitamins B12 and D levels
- Urinalysis
- Urine for micro-proteinuria

Women with obesity and symptoms of polycystic ovary syndrome

- LH, FSH, total testosterone, DHEAS, prolactin and 17 hydroxyprogesterone levels

LH: luteinizing hormone; FSH: follicle stimulating hormone; DHEAS: dehydroepiandrosterone; TIBC: total iron binding capacity.

Table 8: Summary of Weight-Promoting Medications and Alternate Therapies

Category	Class	Name	Weight gain	Alternative therapy
Antihyperglycemics	Insulins	Insulin	↑↑	Biguanide (metformin) DPP4i (alogliptin, linagliptin, sitagliptin, saxagliptin) GLP1 analogs (exenatide, liraglutide, dulaglutide, semaglutide) AGI (acarbose, miglitol) SGLT2 inhibitors (canagliflozin, dapagliflozin, empagliflozin) Pioglitazone/metformin* Glipizide/metformin* Glyburide/metformin*
	Thiazolidinedione	Pioglitazone	↑↑	
	Sulfonylureas	Glipizide	↑	
		Glyburide	↑↑	
		Glimepiride	↑↑	
		Chlorpropamide Tolbutamide Gliclazide	↑↑ ↑↑ ↑↑	
	Meglitinides	Repaglinide	↑	
Antidepressants	Tricyclics	Amitriptyline Doxepin Imipramine Nortriptyline	↑↑↑ ↑↑↑ ↑↑ ↑↑	Bupropion Nefazodone Duloxetine Venlafaxine Desvenlafaxine Trazodone Levomilnacipran Vilazodone Vortioxetine Selegiline (topical MAOIs)
	Atypical	Mirtazapine	↑↑	
	MAOIs	Phenelzine Tranylcypromine	↑↑↑ ↑↑↑	
	Selective Serotonin Reuptake Inhibitors (SSRIs)	Sertraline Paroxetine Citalopram Escitalopram Fluoxetine	↑ ↑↑ ↑↑↑ ↑↑ ↑↑↑	Fluvoxamine (variable weight effect)
	Lithium	Lithium	↑↑	
Antipsychotics		Haloperidol Loxapine Clozapine Chlorpromazine Fluphenazine Risperidone Olanzapine Quetiapine Iloperidone Sertindole	↑↑ ↑↑ ↑↑ ↑↑ ↑↑ ↑ ↑↑ ↑↑ ↑↑ ↑	Ziprasidone Lurasidone Aripiprazole
Anticonvulsants		Valproic Acid Carbamazepine Gabapentin	↑↑↑ ↑↑↑ ↑↑↑	Topiramate Zonisamide Lamotrigine
Corticosteroids	Oral steroids	Prednisone Prednisolone Cortisone	↑↑↑ ↑↑↑ ↑↑↑	Budesonide NSAIDs
	Inhaled steroids	Ciclesonide Fluticasone	↑ ↑	
Hormone replacement therapy	Estrogens Progestogens		↑↑ ↑	
Antihistamines		Diphenhydramine	↑	Oxymetazoline
Beta blockers		Propranolol	↑	ACEi ARBs CCBs (may cause fluid retention) Timolol
		Metoprolol Atenolol	↑ ↑↑	
Antihypertensive		Clonidine	↑	Prazosin ACEi ARBs Diuretics

DPP4i: Inhibitors of dipeptidyl peptidase 4; GLP-1: Glucagon-like peptide-1 receptor agonists; NSAIDs: Nonsteroidal anti-inflammatory drugs: SGLT-2: Sodium glucose co-transporter 2; AGI: Alpha-glucosidase inhibitor; ACEi: Angiotensin converting inhibitors; ARBs: Angiotensin II receptors blockers; CCBs: Calcium channel blockers; MAOIs: Monoamine oxidase inhibitors; SSRIs: Selective serotonin reuptake inhibitors;*Combination therapy is less likely to cause weight gain; ↑/↑ variable reported effect; ↑ up to 5 kg weight gain; ↑↑ 5 to 10 kg weight gain; ↑↑↑ more than 10 kg weight gain.

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The summary of the Canadian Adult Obesity Clinical Practice Guideline is published in the *Canadian Medical Association Journal*, and contains information on the full methodology, management of authors' competing interests, a brief overview of all recommendations and other details. More detailed guideline chapters are published on the Obesity Canada website at www.obesitycanada.ca/guidelines.

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