

〈Review〉

Obesity and Perioperative management – Review –

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ABSTRACT Obesity is a contributing factor to life-style related diseases such as diabetes, hypertension and dyslipidemia, as well as being a cause of metabolic syndromes. It has been predicted that more than half of the adult population in the world might be obese within the next twenty years. Once a person is diagnosed with metabolic syndrome, conditions such as diabetes, hypertension and dyslipidemia may remain mild even while visceral fat obesity slowly advances arterial sclerosis. Eventually, severe clinical conditions such as heart diseases and stroke can result. In recent years, there are more and more patients diagnosed with morbid obesity both inside and outside of Japan. This case report will discuss some concerns and tasks in treating patients with obesity and morbid obesity.

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Key words : Obesity, Perioperative management, Metabolic syndrome

INTRODUCTION

Along with the Westernization of dietary habits in Japan, there have been an increasing number of obese patients reported across all age groups¹⁾. The obesity rate for young people is increasing, with an especially higher increase among children compared to the increase among adults²⁾. In the United States, the obesity rate among children between 2007 and 2012 increased more than 50%. Additionally, 90% of obese children become obese adults, along with an elevated risk of developing arterial sclerosis and type 2 diabetes³⁻⁵⁾. The number of obese patients

needing treatment for various illnesses is increasing, and therefore it's becoming more important to understand the clinical conditions of the obese^{3, 5)}.

Problems associated with morbid obesity

The degree of obesity is usually determined by body mass index (BMI), which is weight (kg) divided by height squared (m²). Obesity was previously categorized as a person weighing over 20% more than their ideal weight. However, the latest standard for obesity in Japan is a BMI \geq 25. In Western countries, a BMI \geq 30 is considered obese,

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but only 10% of Japanese have a BMI ≥ 30 and tend to develop obesity related illnesses when their BMI is 25 or higher¹⁻⁵. Asians tend to accumulate less subcutaneous fat from excessive nutrients, but are known to develop visceral adiposity instead^{6, 7}. Of particularly note is that Asians generally have worse health outcomes from metabolic syndromes related diseases, such as diabetes, than from obesity itself⁶⁻⁸.

Obesity cause various kinds of organ damage through each mechanism (Fig. 1)⁵. The cardiovascular systems of the obese are characterized by increases in cardiac output, intravascular volume and sympathetic nervous system tone^{9, 10}. These changes can lead to left ventricle hypertrophy, ischemic cardiac diseases, heart failure and atrial fibrillation⁵. Accumulated fat around cardiac muscle can develop into obesity-associated cardiomyopathy but losing weight can improve circulatory dynamics and reverse

myocardial remodeling^{10, 11}.

Possible changes in the respiratory system are an increase of soft tissue in the tongue and in the area surrounding the pharynx⁵. As obesity worsens, the upper respiratory tract narrows, restricting the smooth movement of the pharyngeal dilator muscles. The movements of the diaphragm and the pleura also become restricted as visceral and subcutaneous fat accumulate. Lung volume and lung compliance can also decrease and any ventilation perfusion ratio inequality can lead to a decrease in respiratory function⁵.

Vital capacity and BMI are known to be inversely proportional, and severely obese patients have a remarkably lower one-time ventilatory volume and a shortened inspiratory time. Moreover, chronic hypoxemia can trigger polycythemia, hypertension, right ventricular failure and arrhythmia and eventually can cause poor circulatory dynamics⁵. Obese patients with a high BMI need to be careful

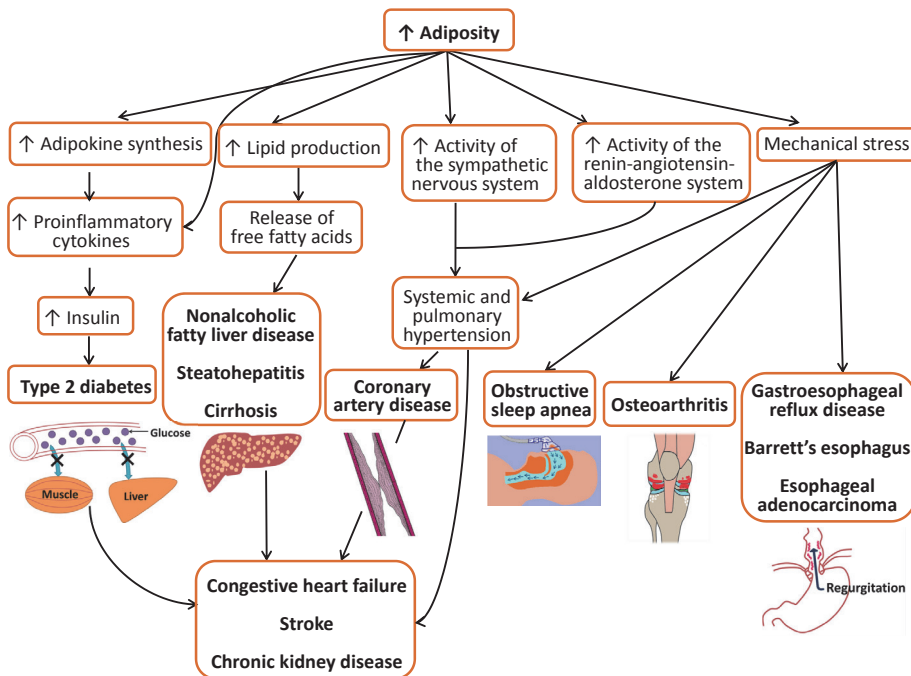


Fig. 1. Some pathways through which express adiposity leads to major risk factors and chronic diseases. (Figure is adapted and modified from a figure of reference No. 5.)

of not only obstructive sleep apnea (OSA) but also of obesity-hypoventilation syndrome (OHS)^{5, 12, 13}.

Problems during the perioperative period

During the course of surgical treatment, obese patients are especially known to develop complications from metabolic abnormalities such as metabolic acidosis, hypocalcemia alkalosis and postoperative diabetes¹³. Obese Asian patients develop complications more often even at lower BMIs and their reserve capacity is also lower^{6, 7}. For digestive tract surgeries, creating the operative field is more difficult when patients are obese and more secure surgical techniques are required because obese patients have weaker blood vessels and tissues¹⁴. Also, additional attention is required to avoid postoperative complications such as arterial sclerosis, cardiac diseases, pneumonia and kidney failure¹⁵⁻¹⁷.

The specificities of the respiratory and the circulatory systems of obese patients require some precautions during perioperative care management¹⁴. Obese patients have lower thoracic compliance due to the thoracic load and are more likely to have diaphragmatic eventration due to the abdominal wall load and the increased content in the abdominal cavity^{10, 15}. Peripheral airway narrowing causes a fistula formation, which can trigger hypoxemia^{14, 15}. These patients have a faster respiratory rate that lowers vital capacity, expiratory reserve volume and functional residual capacity. This lower respiratory function worsens the reaction to carbon dioxide in the blood in the respiratory center, and thus the chance of respiratory failure becomes even higher.

Excessive fat deposits in the airway can cause occlusive respiratory impairment, but this can be taken care of effectively by preoperative continuous positive airway pressure (CPAP)^{18, 19}. Keeping the head-side up and doing early sitting exercises can be effective, as well as intermittent positive pressure

ventilation and chest percussion to treat atelectasis and pneumonia that may occur postoperatively in obese patients.

Obese patients with an excessive amount of fat in the abdominal cavity often lay down or sit in the same position for long periods of time. This can trigger venous stasis in the lower limbs which can cause venous thrombosis⁵. Pulmonary infarction caused by postoperative venous thrombosis in an obese patient's lower limbs is a complication that requires a great deal of attention to take care of. Early ambulation, raising the legs while sleeping at night and wrapping the lower limbs with the elastic bandages are effective ways to prevent these complications^{14, 15}.

As for the circulatory system, the workload of an obese patient's heart is increased and they often have hypertension as a complication, with an accompanying higher chance of heart failure⁵. Prior to surgery, stress electrocardiography and echocardiography tests are recommended. Renal function needs to be evaluated as well. Dyslipidemia and hypercholesterolemia often occur as complications, and coronary artery disease can increase^{20, 21}. The stress electrocardiogram needs to be checked again if the patient has any discomfort in the chest or dyspnea before surgery²².

Wilkinson KH showed super-super obesity patients had increased 30-day post-operative complications after both laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy compared to super obesity patients (15.2% vs 12.6%, $p < 0.0005$). During postoperative wound healing, obese patients who have high insulin resistance have poor granuloma formation which can cause colliquative necrosis of the subcutaneous adipocytes more often than in other patients^{19, 23}. Moreover, the immune system tends to be depressed and keeping the skin clean is more challenging due to the skin sag, so any infection can easily cause wound dehiscence. To avoid these problems

a transverse incision is preferable to a paramedian incision, which is in turn better than a median incision. Also, a layer to layer closure is required. Additionally, preventative antibiotics before surgery and thorough hygiene management after surgery are important. The minimally invasive surgery, for example laparoscopic or thoracoscopic procedure, is certainly recommended to reduce complications²⁴⁾.

CONCLUSION

There have been changes in environmental and host factors, such as an increase of overweight patients from outside of Japan, the change of dietary habits among Japanese people, as well as changes in food preference^{25, 26)}. Due to these factors, medical professionals in Japan should expect to treat more and more obese patients. Therefore, deeper medical knowledge and insights about obese and severely obese patients are required²⁷⁾. Moreover, precise clinical investigations are needed.

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