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Features of cancer management in obese patients

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Contents

Abstract

There is worldwide increased in obesity prevalence and statistical almost half of United-States, including children, could be obese by 2050. Obesity in cancer patients is a major issue in oncology because weight gain and obesity account for approximately 20% of all cancer cases. Indeed, increased obesity is linked with higher risk of various types of cancer and a poorer survival. Although biological mechanisms underlying how obesity causes an increased risk of cancer are suggested, overweight as a putative direct cause of death is still debated. Numerous confounding factors may impact on survival, including comorbidities and imaging limitations. Moreover, difficulties to achieve the standard oncologic care with surgery, chemotherapy and/or radiation may also be concerned. Herein, we examined the specific features and

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potential adaptation of the cancer management in overweighed patients. Then, we reviewed how implicated molecular pathways may provide new strategies to decrease cancer risk and predict toxicities in an increasingly obese population.

Keywords: Obese; Overweight; Bariatric; Cancer risk; Incidence; Toxicity; Treatment; Technical; Adaptation/limitation

1. Introduction

The past three decades have been characterized by a major worldwide increased in obesity prevalence. In 2010, one-third of United-States adults were obese, and nine states reported obesity rates of 30% or more, compared to none in 2000. Despite ambitious national plans, Centers for Disease Control and Prevention showed an annual 1% increase over the last five years. Moreover, statistical predictive model suggested that almost half of United-States, including children, could be obese by 2050 [1,2]. According to the World Health Organization, obesity is defined as abnormal or excessive fat accumulation that presents a risk to health. A crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in meters). BMI is closely related to both percentage body fat and total body fat. Overweight is defined by a BMI of more than 25 kg/m^2 and obesity by a BMI over 30 kg/m^2 (http://www.who.int/topics/obesity/en/) [1].

Obesity is a costly health issue (hundreds of billions of dollars yearly) and one of the leading preventable causes of death worldwide. Indeed, overweight and obesity are major risk factors for a number of chronic diseases, including diabetes, cardiovascular diseases and cancer [3–5]. Obesity in cancer patients is a major issue in oncology because weight gain and obesity account for approximately 20% of all cancer cases [4]. Indeed, large prospective epidemiological studies support the association between obesity and various types of malignancies, including colic, pancreatic, endometrial, renal, gallbladder or esophageal adenocarcinoma, and postmenopausal breast cancer [6]. Besides, historical data from the past 25 years point obesity as a cause of approximately 14% of cancer deaths in men and up to 20% of cancer deaths in women. Compared to normal weight subjects, the relative death rates from all cancers reaches an excess of 62% [4,7]. Relative risks of cancer in term of incidence and prognosis in obese population are reported in Table 1.

Because the exact biological mechanisms underlying how obesity causes an increased risk of cancer are still poorly understood, overweight as a putative direct cause of death is still debated. In fact, confounding factors may include comorbidities and limitations for diagnosis or difficulties to achieve the standard of oncologic care. Herein, we examined the specific features of the cancer management in obese patients. Then, we reviewed how molecular pathways of interest may provide new strategies to decrease cancer risk and toxicity in an increasingly obese population.

Table 1
Relative risks of cancer in obese patients [6,7].

	Incidence[a] [6]		Survival[b] [7]	
	Men	Women	Men	Women
Breast (postmenopausal)	–	1.1	–	2
Cervix	–	N/A	–	3.2
Colon	1.2	1.1	1.9[c]	1.5[c]
Endometrial	–	1.6	–	6.2
Esophagus adenocarcinoma	1.5	1.5	1.9	
Gallbladder	1.1	1.6	1.8	2.6
Ovary	N/A	N/A	N/A	1.5
Leukemia	1.1	1.2	N/A	N/A
Liver	N/A	N/A	4.5	1.7
Melanoma	1.1	1	N/A	N/A
Myeloma	1.1	1.1	1.7	1.4
Non-Hodgkin's lymphoma	1.1	1.1	1.5	2
Pancreas	1.1	1.1	2.6	2.8
Prostate	1	–	1.34	–
Rectum	1.1	1	1.9[c]	1.5[c]
Renal	1.2	1.3	1.7	4.8
Stomach	N/A	N/A	1.9	N/A
Thyroid	1.3	1.1	N/A	N/A
All cancer	N/A	N/A	1.7	1.9

N/A, not available.
[a] Relative risk is expressed per 5 kg/m^2 increased in BMI.
[b] Relative risk is expressed for highest BMI category.
[c] Colon and rectum were pooled.

2. Involvement of obesity in cancer management

2.1. Medical imaging and image-guided intervention challenges in high BMI patients

Challenges for tumor assessment in imaging of obese patients include the physical constraint, including the aperture opening diameter (∼70 cm) and table weight (∼250 kg) of CT (computed-tomography) and MR (magnetic resonance) scans. Although several adaptations of radiologic devices with portable (X-ray/ultrasound), as imaging or upgraded bariatric equipment, are being developed in this setting, obtaining high quality images remains a central point of interest in this population [8–10]. Undeniably, the radiological anatomy of obese patients is modified by the accumulation of adipose tissue (retroperitoneal, subcutaneous fat) and the fatty infiltration of a number of organs (liver, parotids, breast, muscle, etc.). Then, anatomical variant of normal imaging and limits are specific to each imaging technique [11,12].

Although fat can be helpful in a few radiographs such as mammography (improved visibility of a lesion relative to the surrounding fat), increased BMI induces higher X-ray beam attenuation with lower image contrast. Moreover, body thickness increases exposure time and induces a higher potential