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Case Report

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Obese Patients: The Most Prone to Heart Disease, Yet the Least Benefiting from Cardiac Imaging and Treatment Technology

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Abstract

Background: Morbid obesity seems to be spreading as an epidemic. With a prevalence of 10 %, it is the cause of many illnesses and co- morbidities, specifically heart disease. Most hospitals in the United States have neither the facilities nor the equipment to accommodate obese patients. This makes adequate care difficult to offer in some cases.

Objective: Our goal is to highlight the lack of accommodation in imaging for morbidly obese patients. Manufacturing companies of diagnostic and therapeutic imaging modalities should consider increasing the weight limit allowable. Meanwhile, patient education is an important step in preventing this rising problem. We also aim at raising healthcare provider's awareness of the importance of educating patients on weight control and healthy habits.

Case reports: We present two case reports that prove that our modern medical equipment is not ready for obese patients. The first case is a 20-year-old male weight: 262 kg (576.4 lbs), Height: 175 cm (68.9 inches), Body Mass index (BMI): 85.6. The second case is a 39-year-old female with morbid obesity, weight: 320.8 kg (705.8 lbs), height: 157.5 cm (62 inches), body mass index (BMI): 129.3. In both cases computed tomography scan as well as cardiac catheterizations could not be performed because of the patient's weights exceeding the maximum allowable limits.

Conclusion: The inability of modern medical equipment, especially imaging, to support more than 400 pounds is an obstacle to the diagnosis and treatments of the population the most prone to heart disease.

Keywords

Morbid obesity; Technology; Diagnostic; Therapeutic; Limitations

Introduction

Speed is the trait of our modern time. Although the technological revolution has many benefits, one of its drawbacks is the fast pace behaviors that it teaches! Fast food is the product of a fast paced life. It is also the cause of the rise in obesity rates. The contrast between the advancement of medicine and the increase of disease caused by unhealthy habits is striking. In medical imaging, obese patients, the ones more prone to cardiovascular disease, benefit the least from equipment that assist in diagnosis and often times in treatment.

Case presentation 1

A 20-year-old male with morbid obesity, weight: 262 kg (576.4 lbs), Height: 175 cm (68.9 inches), Body Mass index (BMI): 85.6, presented to our hospital in Memphis, TN with dyspnea on exertion and at rest, orthopnea, paroxysmal nocturnal dyspnea as well as chest pain and discomfort. The clinical presentation with signs and symptoms were suggestive of heart failure and possible unstable angina. This was confirmed by Chest X-Ray (CXR) showing bilateral interstitial pulmonary edema, and elevated Brain Natriuretic Peptide (BNP) levels at 7,181 pg/mL (Normal: < 100 pg/mL). Electrocardiogram (EKG) showed sinus tachycardia, poor R-wave progression, Q-wave anteroseptally, and STT segment changes, suggestive of possible anteroseptal infarct, age undeterminate and lateral ischemia. Troponins were mildly elevated at 0.9 ng/mL (N: < 0.05 ng/mL). The patient was started on diuresis, aspirin, statin, and anticoagulation. An echocardiogram (with low quality pictures because of patient's heavy weight and body habitus), revealed ejection fraction to be roughly 20-25%, which is severely lowered (Normal: 55-60%). A Ventilation-Perfusion (V-Q) scan was performed to show intermediate probability for pulmonary embolism. No computed tomographic scan was possible to be performed in view of the patient's morbid obesity with his weight exceeding the maximal allowable limits of the scanner. A cardiac catheterization was also recommended to further evaluate for potential coronary artery disease in a young patient with significant cardiomyopathy, but unfortunately could not be performed either, due to the patient's weight exceeding limits of cardiac catheterization table.

Case presentation 2

A 39-year-old female with obstructive sleep apnea and morbid obesity, weight: 320.8 kg (705.8 lbs), height: 157.5 cm (62 inches), body mass index (BMI): 129.3, presented to our hospital in Memphis, TN with chest pain and significant shortness of breath, orthopnea, and paroxysmal nocturnal dyspnea (PND). She reported experiencing chest pain for one week. She described the left-sided chest discomfort as a tight, achy-like sensation that occurs intermittently and lasting for about 15 minutes to one hour. The pain has become progressively worse for two to three days. She rated the chest discomfort at 9 out of 10 with associated radiation to the left arm. She reported receiving nitroglycerin twice en route to the emergency room, which alleviated the chest discomfort. Upon presentation to the emergency room, she was found to be in severe respiratory distress, and her partial pressure arterial oxygen (PAO2) was 60, and oxygen saturation was 80%. She was admitted for further evaluation and treatment.

Electrocardiogram showed normal sinus rhythm, and poor R-wave progression with Q-waves in V1 and V2: cannot rule out anteroseptal infarct, age undeterminate. An Echocardiogram (with low quality pictures due to patient's weight and body habitus), revealed lowered ejection fraction (EF) at 35%. Troponins were mildly

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elevated at 0.8 ng/mL (N: <0.05 ng/mL). Brain Natriuretic Peptide (BNP) levels were mildly elevated at 355 pg/mL (Normal: <100 pg/mL). Chest X-Ray revealed cardiomegaly with interstitial prominence consistent with early pulmonary edema.

A computed tomography scan to rule out pulmonary embolism or aortic dissection could not be obtained due to inability of the patient to fit in the scanner, hence a Ventilation-Perfusion (VQ) scan was done to reveal intermediate probability for pulmonary embolism. A nuclear stress test (planar scan was obtained due to inability to obtain myocardial perfusion SPECT in view of patient's weight) was mildly positive. Because of the patient's inability to fit on a cardiac catheterization table due to her weight exceeding the maximum allowable limits, the test unfortunately could not be performed. Patient was treated medically with diuresis, aspirin, statin, and anticoagulation.

Discussion

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems [1]. It is evaluated in terms of fat distribution via the waist–hip ratio and total cardiovascular risk factors. Obesity is further defined by the body mass index (BMI), which is closely related to both percentage body fat and total body fat [2].

Body mass index (BMI), a measurement that compares weight and height, defines people as overweight (pre-obese) if their BMI is between 25 and 30 kg/m^2, and obese when it is greater than 30 kg/m^2. The most commonly used definitions, established by the World Health Organization (WHO) in 1997 are published in 2000. Some modifications to the WHO definitions have been made by particular bodies. Class I obesity: 30-34.9, Class II obesity: 35.0-39.9, class III obesity: ≥40.0.

The surgical literature breaks down "class II and III" obesity into further categories whose exact values are still disputed: *severe obesity as* BMI ≥35 -40, *morbid obesity as* BMI of ≥40–44.9 or 49.9, *and super obesity as* BMI of ≥45 or 50.

As Asian populations develop negative health consequences at a lower BMI than Caucasians, some nations have redefined obesity; the Japanese have defined obesity as any BMI greater than 25, whereas China uses a BMI of greater than 28.

Obesity is a leading preventable cause of death worldwide, with increasing prevalence in adults and children, and authorities view it as one of the most serious public health problems of the 21st century [3]. On average, obesity reduces life expectancy by six to seven years: [4] a BMI of 30–35 reduces life expectancy by two to four years, while severe obesity (BMI >40) reduces life expectancy by 10 years [5]. From 1971 to 2000, obesity rates in the United States increased from 14.5% to 30.9% [6].

Before the 20th century, obesity was rare; in 1997 the WHO formally recognized obesity as a global epidemic. As of 2005 the WHO estimates that at least 400 million adults (9.8%) are obese, with higher rates among women than men [7]. The rate of obesity also increases with age at least up to 50 or 60 years and severe obesity in the United States, Australia, and Canada is increasing faster than the overall rate of obesity [8].

Specific industries, such as the airline and food industries, have special concerns. Due to rising rates of obesity, airlines face higher fuel costs and pressures to increase seating width. In 2000, the extra weight of obese passengers cost airlines US$275 million [9]. Costs for restaurants are increased by litigation accusing them of causing obesity.

Childhood obesity has reached epidemic proportions in the 21st century, with rising rates in both the developed and developing world. Rates of obesity in Canadian boys have increased from 11% in 1980s to over 30% in 1990s while during this same period rates increased from 4 to 14% in Brazilian children.

Obesity increases the likelihood of various diseases, particularly heart disease, type 2 diabetes, obstructive sleep apnea, certain types of cancer, and osteoarthritis [1]. Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications, or psychiatric illness. Evidence to support the view that some obese people eat little yet gain weight due to a slow metabolism is limited; on average obese people have a greater energy expenditure than their thin counterparts due to the energy required to maintain an increased body mass [10].

The Greeks were the first to recognize obesity as a medical disorder. Hippocrates wrote that "Corpulence is not only a disease itself, but the harbinger of others"[1]. The Indian surgeon Sushruta (6th century BCE) related obesity to diabetes and heart disorders. He recommended physical work to help cure it and its side effects. For most of human history, mankind struggled with food scarcity. Obesity has thus historically been viewed as a sign of wealth and prosperity. It was common among high officials in Europe in the Middle Ages and the Renaissance as well as in Ancient East Asian civilizations [11].

In addition to its health impacts, obesity leads to many problems, including disadvantages in employment and increased business costs. These consequences are believed by all levels of society including individuals, corporations, and governments.

Once considered a problem only of high-income countries, obesity rates are rising worldwide and affecting both the developed and developing world [12]. These increases have been felt most dramatically in urban settings. The only remaining region of the world where obesity is not common is sub-Saharan Africa [1].

The estimate range for annual expenditures on diet products is $40 billion to $100 billion in the US alone. In 1998, the medical costs attributable to obesity in the US were $78.5 billion or 9.1% of all medical expenditures, [13] while the cost of obesity in Canada was estimated at CA $2 billion in 1997 (2.4% of total health costs). The total annual direct cost of overweight and obesity in Australia in 2005 was AUD $21 billion. Overweight and obese Australians also received AUD $35.6 billion in government subsidies.

When obese patients present to the hospital with medical issues, special arrangements have to be made to accommodate them. These include but are not limited to: a special blood pressure cuff, a special bed, special transportation, etc.

Concerning diagnostic and therapeutic tests, there is a weight limit on most Computed Tomographic (CT) scanners (450 lbs), Magnetic Resonance Imaging (MRI) machines (550 lbs), Bone Density (DEXA) scan (450 lbs), Diagnostic X-Ray:

- Fluroscopy: standing weight limit (300 lbs-350 lbs), - Digital radiology (500 lbs), Nuclear Medicine (500 lbs), Cardiac Catheterization tables (500 lbs), and Echocardiogram. There is no limit on the latter, however lower quality studies are common with larger size patients. In the case of cardiac catheterization from a common femoral arterial access, a special longer sheath is often needed in obese patients. Arm or radial access proved to be a safer approach to avoid significant bleeding complications.

In the previous two cases we discussed the inability to perform a CT scan because the patients' weight exceeded the limits of the scanner. Later, when those same patients needed cardiac catheterizations we could perform them neither in our hospital nor in any other hospital in Memphis, TN. This weight restriction exists in most of the United States hospitals where medical equipment has limited weight capacity.

Conclusion

In summary, obese patients have to face a double hardship; the increased risk of heart disease and the inability to benefit from advanced medical equipment. The purpose of this manuscript is to highlight that existing problem hoping that as technology advances, imaging machines will be designed to accommodate morbidly obese patients. Meanwhile, physicians and health care professionals must consider patient education as a preventative measure to overweight that could easily turn into obesity with all of its medical complications.

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