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Chronic pain in the obese population: is exercise the key?

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INTRODUCTION

There are over 500 million adults worldwide classified as obese and a further 1.5 billion individuals classified as overweight [1]. Individuals with a high body mass index (BMI) are more likely to report chronic pain than their leaner counterparts and are more sensitive to pain [2]. Recently in this journal, Narouze and Souzdalnitski [3] reviewed pain management techniques and interventional approaches for weight reduction for individuals who are obese. They recommended that medication, rehabilitation, and interventional management strategies should be used to manage individuals with chronic pain and obesity and that this should be possible within the present infrastructure for pain management. In this article, we extend their argument by considering the role of exercise in the management of chronic pain for individuals who are overweight or obese by exploring the inter-relationships between pain, obesity, low-grade systemic inflammation and exercise.

HOW ARE CHRONIC PAIN AND OBESITY LINKED?

Evidence suggests that the positive association between chronic pain and obesity is mediated in part by abnormal loading on weight-bearing joints such as the knees, hips and spine leading to postural changes, muscle weakness and mechanical strain on connective tissues [4]. Hence, weight loss is a common goal in the management of pain in overweight and obese individuals. Weight loss through dietary modification is notoriously difficult to achieve and maintain and may be accompanied by loss of fat-free mass which can lower metabolic rate making maintenance of lower weight more difficult [5]. Exercise targets excess body fat and promotes improvements in cardiovascular risk factors even if no weight is lost [6]. Exercise also improves the sense of well-being by reducing depression and improving sleep which in turn improves the quality of life and lessens the psychological impact of chronic pain. A recent systematic review provided evidence that pain and function improved in individuals with osteoarthritis receiving exercise therapy and that these effects were mediated by increased upper leg strength, decreased extension impairments and improvements in proprioception [7]. A meta-analysis found that effect sizes of hypoalgesic outcomes associated with exercise for individuals with chronic pain were variable and dependent on diagnosis and on the intensity of the exercise [8]. However, the meta-analysis provided strong evidence that acute isometric, aerobic, and dynamic resistance exercise reduced experimentally-induced pain in healthy individuals. This reduction in pain sensitivity response in the short-term is likely to be mediated in part through activation of descending pain inhibitory systems and the release of endorphins [9]. It is also plausible that therapeutic exercise may influence systemic concentrations of pro-inflammatory

biomarkers associated with obesity and a number of studies have demonstrated this relationship (for review see [10]).

THE ROLE OF EXERCISE

The emergence of evidence that individuals who are obese may exhibit a low grade pro-inflammatory state offers new insights to the role of therapeutic exercise for these individuals. Excessive body weight contributes to adiposopathy ('sick fat') which results in elevated concentrations of pro-inflammatory biomarkers in the systemic circulation which are secreted by adipose tissue. These include prostaglandins, C-reactive protein (CRP), and cytokines such as interleukins (e.g. interleukin-6), tumor necrosis factor alpha (TNF-alpha), and leptin, all of which sensitise nociceptors resulting in an amplified nociceptive input to the central nervous system [10]. Hence, adiposopathy may contribute to non-resolving systemic inflammation and states of persistent pain. Furthermore, un-resolving systemic inflammation may contribute to continued sensitisation of the nociceptive system. Consumption of foods rich in carbohydrate that result in postprandial elevation in blood glucose cause repetitive acute inflammation that can worsen systemic inflammation [11]. Research suggests that weight loss reduces the levels of pro-inflammatory markers in fibromyalgia [12], low back pain [13] and osteoarthritis of the knee [4]. It has also been claimed that exercise itself has a prophylactic effect on the development of some pain conditions such as fibromyalgia syndrome, and neck, shoulder and back pain [14]. Evidence from large population cohort studies suggests that exercise reduces systemic inflammation independent of weight loss [15]. Reduced adipose tissue hypoxia from increased tissue perfusion associated with exercise may be a potential mechanism [16]. Thus, exercise has the potential to reduce low grade systemic inflammation, decrease mechanical loading and improve psychological state in addition to having other health benefits such as improved cardiovascular risk status [17].

THE CHALLENGE

There are a variety of challenges implementing exercise therapy into clinical practice including adherence, dosage and optimising exercise and recovery between treatments [18]. Adherence to regular exercise is challenging for individuals who are in pain and obese, especially as they may well be habitually sedentary. Attrition rates can be as high as 50% for adults engaging in exercise programmes so perhaps the way forward is to try and integrate more exercise into the normal daily routine. In their meta-analysis of the hypoalgesic effects of exercise, Naugle et al. were unable to determine the optimal dose of exercise needed to produce hypoalgesia [8]. Moreover, there are no guidelines for exercise prescription to reduce systemic inflammation, so advice is taken from

investigations of physical activity on body fat. Studies by Tudor-Locke et al. suggest that as little as 30 minutes walking activity per day, equating to approximately 3,000 extra steps (equivalent to approximately 30 minutes of activity), will be sufficient for improving general health including cardiovascular risk factors and weight control [19]. This can be achieved by integrating exercise into activities of daily living and therefore does not need to be prescriptive, formal or unpleasant. Several short bouts of exercise are as effective as fewer longer sessions, so increasing exercise can be as simple as encouraging less use of the car, taking the stairs more often or taking the dog for a walk for an extra 10 minutes [20]. For this to happen it is necessary to create the right social conditions that result in health for all. This would include the creation of environments supportive of exercise such as for example improved public transport, cycle lanes, pedestrian safety, and subsidised swimming and leisure facilities. Workplace exercise promotion such as cycle to work schemes or lunchtime exercise groups are also effective. Health promotion can play a major part in developing a 'social model of health' as we have discussed in a previous Editorial in this journal [21].

THE WAY FORWARD

In these stringent times we have in our pain management toolbox a potentially cost-effective way of dealing with the increasing prevalence of chronic pain whilst simultaneously helping us tackle some of the other health problems caused by obesity. Factors contributing to an increased prevalence and severity of chronic pain in individuals who are obese include systemic inflammation, mechanical overload, and autonomic dysfunction. Reductions in abdominal fat decreases circulating levels of pro-inflammatory biomarkers that may contribute to chronic pain. Further research is necessary to reveal precisely how much exercise is effective in reducing systemic inflammation and decreasing pain with or without weight loss. There is a need for evidence-based guidelines which should provide direction on appropriate types and amount of exercise required for the reduction of pain.

Nevertheless, there is already sufficient available evidence to meet the challenge head-on and start encouraging our obese patients to take more walking steps daily as a first-line treatment for chronic pain.

KEYWORDS

Chronic pain, Obesity, Exercise, Physical Activity, Systemic Inflammation, Cytokines, Pain Management

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