

Obesity and Knee Arthroscopy – a Review

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ABSTRACT

Obesity is currently a global epidemic, often referred to as “globesity”, impacting the life of millions worldwide. A risk factor for many diseases, obesity can also be linked to developing intra-articular lesions of the knee, affecting the menisci, ligaments and cartilage. Furthermore, obesity has been shown to influence the outcome of surgical interventions, including those of the musculoskeletal system. Although many studies addressed the relationship of obesity and joint replacement, articles relating to arthroscopy and obesity, and knee arthroscopy in particular, are a bit scarcer. The majority of data suggest that an increase in BMI leads to a similar increase in the rates of intra- and postoperative complications, and most authors agree that a higher body mass index can influence both the procedure itself and its outcomes, including the subjective results reported by the patients. Still, some studies show different results, especially in patients that are overweight or with low-grade obesity, where the outcomes are comparable to those of the non-obese population. Thus, it can be concluded that obesity is an important patient characteristic that needs to be taken into consideration when planning, performing, and assessing the results of knee arthroscopy.

Keywords: obesity, arthroscopy, articular lesions

OBESITY — A GLOBAL ISSUE

Obesity has grown into a worldwide epidemic, with over one billion people affected and with a multitude of associated health problems and risks. A recent pooled analysis of 1.698 population-based studies, including over 19 million participants, has concluded that the prevalence of obesity has been increasing all around the world, and by 2025, an estimated 18% of men and over 20% of women will be obese, while severe obesity will have a prevalence of over 6% in men and 9% in women.¹ In the USA, obesity rates in both adults and children are alarmingly high — 37.7% and 17%, respectively.^{2–5} Similarly high rates of obesity are also present in many European countries, especially the UK, Malta, Latvia, Hungary and Estonia. The 2008 International Association for the Study of Obesity (IASO) data for EU27 provided high obesity rate estimates — over 53% of the EU population being overweight or obese.⁶ This means >143 million overweight adults and 68.5 million obese adults. More males are overweight com-

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pared to females, but more females are obese compared to males. Interestingly, overweight and obesity rates in Romania are lower compared to other European countries; obesity rates amongst Romanian males was the second lowest in Europe (7.6%, second only to Sweden's 7.0%), with similarly low rates in women. Still, data released in 2013 by the World Health Organization (WHO) predicted an increase in the incidence of obesity for Romania, affecting 12% of men and 9% of women by 2020, and 15% of men and 10% of women by 2030.⁷

Although it has been shown that there is a genetic predisposition for obesity, an obesogenic environment can also be blamed.⁸ The latter is based on the abundance of high-caloric foods with a low nutritional value, coupled with reduced energy expenditures, all related to the westernized lifestyle that has been gaining more popularity worldwide since the 1980's. The root causes of "globesity" seem to be governmental policies and the food industry.^{9,10}

OBESITY AND PATHOLOGY

Obesity is a risk factor for a whole array of conditions, from infectious diseases to cancer.¹¹⁻¹⁷ The most well-known association is that of obesity with cardiovascular diseases (including atrial fibrillation, hypertension and heart failure) and type 2 diabetes mellitus.¹⁸⁻²⁶ There is also a well-documented effect of obesity on the large joints of the lower limb, with changes in joint biomechanics and biology, often leading to osteoarthritis (OA).²⁷⁻³⁶ Furthermore, obesity has been shown to have a negative effect on postoperative outcomes of many surgical interventions, including those of orthopedics and traumatology.³⁷⁻⁴³

Intra-articular lesions and changes of the knee, including those of the menisci, cruciate ligaments and synovial membrane, have been linked to obesity in many studies.⁴⁴⁻⁵⁰ More importantly, obesity seems to be related to lesions of the articular cartilage of the knee, even in the absence of OA, in adults and children alike.⁵¹⁻⁵⁷

KNEE BIOMECHANICS IN OBESITY AND THE MOLECULAR LINK

With the increase in body weight and mass, obesity alters the way the body creates and reacts to forces. Depending on body mass distribution, obesity can modify the body's center of mass, creating imbalances that can influence gait and stability.⁵⁸ If these changes are present from childhood, they can be predisposing factors for knee angular deformities, thus possibly leading to OA in adults.^{59,60} Ex-

cess adiposity also reduces joint range of motion, consequently changing functional movement.^{61,62} The increased ground reaction forces, and compressive and shear forces produced by obesity in the knee joint might be causative factors for developing cartilage lesions that can evolve towards OA.^{32,63}

As obesity is also associated with the presence of OA in non-weight bearing joints, it seems that the connection between the two must also be related to other factors besides the biomechanics of overload. Many researchers sought the answer to the question: what links obesity to cartilage lesions at a molecular level? Unfortunately, the precise underlying cellular and molecular mechanisms are still not clear, but there has been a lot of progress in this direction. Basically, OA is now considered an inflammatory disease rather than one caused by "wear and tear".⁶⁴ It seems that the involved inflammation can be triggered by the innate immune system, local production of inflammatory mediators, aging, or even estrogen regulation.⁶⁴

In their 2011 review article, Bonet *et al.* offer a thorough analysis of the molecular links between obesity and OA, identifying adipose tissue-derived inflammatory mediators, oxidative stress and hyperlipidemia as risk factors for joint degeneration.⁶⁵ They also outlined the regulatory factors involved in the maintenance and function of both the adipose tissue and articular joint tissues, such as the adipocytokines resistin, leptin, interleukin (IL) 1 β , IL-6, and tumor necrosis factor alpha (TNF- α), which are involved in the pathophysiology of obesity and OA.^{65,66}

From the mentioned cytokines produced by the adipose tissue, leptin seems to be an excellent candidate for a mediator that links obesity to OA. Not only do obese patients present increased levels of leptin in their synovial fluid, but also an enhanced sensitivity of the cartilage for leptin. Cartilage expresses leptin receptors, through which this metabolic regulator hormone can induce the production of nitric oxide (NO), pro-inflammatory cytokines and matrix metalloproteinases (MPPs), leading to cartilage destruction.⁶⁶⁻⁶⁹

Interestingly, biomechanical factors can also influence the development of OA through the activation of cellular inflammation and the promotion of oxidative stress.⁶⁹ Hence abnormal mechanical joint stress such as stretch, compression of shear forces, are detected by the mechanoreceptors on cells from the joint surface. These in turn convert these mechanical signals into intracellular ones, resulting in the overexpression of prostaglandins, cytokines and chemokines, mainly through the nuclear factor-kB (NF-kB) and mitogen-activated protein kinase (MAPK) pathways.⁶⁴

OBESITY AND KNEE ARTHROSCOPY

Although recently there has been some debate about the usefulness of knee arthroscopy as a therapeutic technique, the procedure is still very effective if the indications are well chosen.^{70–74} Additionally, the advantages related to the minimally invasive nature of the technique usually recommend it as a better option compared to procedures involving arthrotomy.

Like any other surgical intervention, knee arthroscopy does have certain potential complications. These include deep venous thrombosis, pulmonary embolus, infections, and even nerve and vascular injury, as well as iatrogenic chondral injury. Some of the used materials and devices (screws, fixation devices, bioabsorbable materials, etc) also have associated complications. By analyzing self-reported complication rates for 92,565 knee arthroscopic procedures, Salzler *et al.* found an overall complication rate of 4.7%, of which surgical complications accounted for 3.68%.⁷⁵ Unfortunately, they only assessed patient age and gender, and body mass index (BMI) was not taken into account. However, in a similar study, Hagino *et al.* reported a much lower complication rate of 0.27% (7 out of the 2,623 cases studied).⁷⁶

The role of obesity has been long debated in knee surgery — both arthroscopy and arthroplasty. When investigating the relationship between obesity and knee arthroscopy, studies have looked at how different intra-articular pathologies relate to obesity, and whether the outcomes of the procedures are influenced in any way by the patient's weight status.⁷⁷ In their prospective study of 541 patients undergoing ACL reconstruction, Kluczynski *et al.* found that obesity was associated with more chondral injuries.⁷⁸ Similarly, Ciccotti *et al.* reported a correlation of articular cartilage lesions with elevated BMI in their cohort of 1,010 patients undergoing knee arthroscopy for meniscal pathologies.⁷⁹ Other authors have also suggested that a high BMI might be a risk factor for meniscal, ligamentous and cartilage injuries of the knee.^{80–83}

MORBID OBESITY AND KNEE ARTHROSCOPY

Morbid obesity is defined as BMI over 40 or 50, and it implies very complex health issues. Unfortunately, in many countries there is a fast growth of morbid obesity rates.⁸⁴

Many studies looked at how morbid obesity is connected to knee arthroplasty outcomes, but only a few studies have analyzed knee arthroscopy, and they are mostly concerned with the technical difficulties encountered in this category of patients. Berg performed a retrospective

assessment of 10 patients with morbid obesity, compared to 10 normal weight patients matched for age, sex, and surgical procedure, in order to identify surgical morbidity and specific technical difficulties.⁸⁵ He found that operative and anesthetic times were greater, possibly because of the difficulties in identifying bony landmarks and the need for using more arthroscopy portals. It might also be hard to find appropriate tourniquets and leg holders for these patients. The author also noted that postoperative assessment was hampered by the size of the knees, and patient recovery and return to normal activities took longer when compared to the normal weight controls.

In their technical note published in 2002, Martinez *et al.* present their recommendations for performing knee arthroscopy in the morbidly obese, with advice regarding patient positioning and portal placement for appropriate visualization of intra-articular structures.⁸⁶

INTRA- AND POSTOPERATIVE COMPLICATIONS AND OUTCOMES

The questions if obesity negatively influences the outcomes of knee arthroscopic procedures, and whether it represents a contraindication in these cases are even more important in view of the growing trend towards overweight and obesity worldwide.

When evaluating studies aimed to identify the influence of overweight and obesity on surgical outcomes, it is important to keep in mind that in retrospective studies based on patient records, obesity might be under-reported. Goode *et al.* found that International Classification of Diseases (ICD) diagnoses codes were more likely to be used in extremely obese patients, while for those with BMI ranging from 25–40 kg/m² the appropriate diagnostic codes were used in only 10% of cases.⁸⁷

Obesity seems to be associated with a significant increase in postoperative complication rates following knee arthroscopy, but BMI is not sufficient for accurately predicting these complications, and other health factors related to obesity also have to be considered.^{88,89}

For arthroscopic meniscus surgery, some studies suggest inferior short-term outcomes of partial meniscectomy in obese compared to non-obese patients, while for meniscus repair, it seems that a BMI ≥ 25 does not increase the risk of failure.^{90,91} In terms of anterior cruciate ligament (ACL) reconstruction, although obese patients can certainly benefit from the procedure, obesity seems to be a strong predictor of knee OA after ACL reconstruction.^{92,93}

Some authors investigated patient-reported outcomes of knee arthroscopy in the overweight and obese, and

reported a negative influence of higher BMI. The questionnaire-based study of Harrison *et al.* revealed that both quality of life and satisfaction with surgery are lower in overweight compared to normal-weight women.⁹⁴ Patient-reported outcomes after ACL reconstruction are also negatively influenced by obesity, especially the perception on joint function.⁹⁵⁻⁹⁷ Interestingly, others have found that subjective results of obese patients are comparable to those of the non-obese.⁹⁸

CONCLUSIONS

Obesity is a risk factor for developing intra-articular lesions of the knee, and has been shown to influence the outcome of surgical interventions, including those of the musculoskeletal system. Many studies addressed the relationship of obesity and joint replacement, but those relating to arthroscopy and obesity, and knee arthroscopy in particular, are a bit scarcer. Most authors agree that a higher body mass index can influence both the procedure itself and its outcomes, including the subjective results reported by the patient, but some have suggested that the outcomes of overweight/low-grade obesity patients are comparable to those of the non-obese population. Thus, it can be concluded that obesity is an important patient characteristic that needs to be taken into consideration when planning, performing, and assessing the results of knee arthroscopy.

CONFLICT OF INTEREST

Nothing to declare.

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