ADOLESCENT OBESITY IS ASSOCIATED WITH MORE SEVERE PRESENTATIONS OF OSTEOCHONDRITIS DISSECANS OF THE KNEE

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Background
Body mass index (BMI) above the normal range has been associated with poorer treatment outcomes in patients with osteochondritis dissecans (OCD) of the knee. Patients with BMIs over 25kg/m2 show an increased risk of postoperative arthritis, and BMI has also been shown to be independently predictive of osteochondral allograft transplantations failure in knee OCD. However, these data have largely focused on post-treatment outcomes relating BMI and OCD. Considering the increase in childhood obesity in the U.S., there is a dearth of research regarding how BMI affects OCD at presentation. This is an especially important question given the effect that various load-bearing forces have on the articular surface. Humeral capitellum lesions in young athletes, for example, have been shown to be more anterior in baseball players than gymnasts, owing to different vectors of force distribution.

In this paper, we asked whether any differences in knee OCD lesions, in terms of either severity or location, were associated with changes in patient BMI. We hypothesized that patients with higher BMI percentiles would have femoral condylar OCD lesions that were more severe at initial presentation and were located more posteriorly on the condyle.

Methods
A retrospective review was performed for patients 10- to 18-years old treated for OCD of the knee at a tertiary-care hospital from 2006-2017. Exclusion criteria consisted of location of OCD other than the femoral condyle and lack of BMI data within three months of presentation. BMI percentile was analyzed as a continuous variable and used to stratify patients into groups per CDC guidelines: underweight, normal, overweight, and obese. Markers of severity included lesion size, cystic changes, subchondral fluid, subchondral edema, and the need for surgical treatment and fixation. Age and laterality were also assessed. Angle of lesion incidence was determined by applying a best fit circle to the distal condyles and measuring the average angle in reference to a line parallel to the femoral axis drawn through the center of the circle. Analysis was performed using t-test and linear regression analysis.

Results
Of 339 patients initially identified with knee OCD, 263 (78%) patients were excluded: 145 (43%) for age >19 years, 31 (9%) for age <10 years, and 86 (25%) for absence of BMI data. For the 77 (23%) patients meeting all inclusion criteria, age at presentation was mean 14.2 (range 10.1-18.8 years). BMI percentile categories were as follows: underweight (n=2, 2.6%), normal (n=50, 64.9%), overweight (n=13, 16.9%), obese (n=12, 15.6%). Linear regression analyses of the cumulative running averages for each variable (Fig.1) demonstrated a moderate correlation between BMI percentile and need for surgical treatment (R2=0.732, p<0.0001). A similar correlation was seen with fluid under lesion (R2=0.716, p<0.0001) and with subchondral edema (R2=0.63, p=0.0001). A similar correlation was seen with fluid under lesion (R2=0.716, p=0.0001) and with subchondral edema (R2=0.63, p=0.0001). Cystic changes were graphically observed to decrease steadily from the 50th to 100th BMI percentiles, though no correlation was observed (R2=0.026). Even with the negative correlation seen with cystic changes, a strong correlation was seen between BMI percentile and patients with at least one sign of lesion instability (R2=0.872, p<0.0001). An inflection point was graphically identified at the 80th BMI percentile for several markers of severity, and subsequent analysis confirmed that patients higher than the 80th percentile were significantly more likely to need surgical fixation (RR: 1.826, 95% CI: 1.03-3.24), to have subchondral edema (RR: 2.523, 95% CI: 1.34-4.76), to have medial condylar lesions (RR: 1.292, 95% CI: 1.014-1.647), and to have lesions located more anterior (Fig. 2) on the condyle (mean=13.41±14.47° for >80th percentile vs 22.52±16.99° for <80th percentile, p<0.05).
Discussion and Conclusions

In this sample, increasing BMI percentile was strongly correlated with the severity of lesion at initial presentation and with the need for surgery. Cystic changes were the only markers of lesion noted to decrease as BMI percentile increased. Given that cystic changes are a sign of a chronic OCD lesion, overweight and obese patients may present earlier in the disease course.

Contrary to our original hypothesis, increasing BMI percentile is actually associated with femoral condylar lesions that are more anterior, rather than more posterior. This finding may be due to a preference for repetitive loading of the knee in the standing position. To our knowledge, this is the first study to show a relationship between BMI and severity or location of femoral condylar OCD at presentation. These results have important implications for the prevention and early detection of OCD in pediatric patients, and they show a role for future biomechanical and population-based studies of body mass on OCD of the femoral condyles.

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