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CORR Insights®: What Differences in Morphologic Features of the Knee Exist Among Patients of Various Races? A Systematic Review

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Where Are We Now?

In their systematic review, the authors of the current study attempted to identify anatomic differences in the knees of patients from different ethnic groups. Behind this analysis undoubtedly is the question of whether there is a need for total

knee components designed for specific ethnic groups in order to achieve better fit.

Kim and colleagues queried studies listed in PubMed and found 30 papers meeting search criteria incorporating similar radiographic measurements of the distal femurs and proximal tibias of white, East Asian, Indian, and black populations. Their analysis of femoral dimensions demonstrated that white patients had slightly larger femoral AP measurements (3 mm mean difference) and slightly smaller femoral aspect ratios (0.05 mean difference) than East Asian patients. White patients also had slightly larger tibial aspect ratios compared to black patients (0.06 mean difference), meaning that the AP dimension of the tibia was deeper in black patients.

Regarding the femoral aspect ratio, knees of East Asianers appeared slightly wider than the components,

meaning that femoral under coverage may be more common in the Asian group. However, we know of no findings to correlate femoral under coverage with clinical failure. In fact, relatively narrow components may mitigate the risk of overhang, which has been implicated as a source of persistent pain after knee arthroplasty [7].

On the tibial side, black patients demonstrated greater AP depth, potentially making it more difficult to optimize tibial coverage. This could lead to poor fixation and increased failure rates of tibial components. Indeed, some have reported higher risk-adjusted rates of revision after TKA for blacks compared to white patients [1, 8], but the reasons for this have not been linked to an increased risk of tibial failure [5]. However, there remains no consensus regarding etiology or perioperative risk [5].

The basic question that must be addressed when considering these findings is whether these morphologic differences are clinically relevant? The sizing range for many modern knee designs encompasses these bone size

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ranges [3]. There are some designs that may not range small enough, but the rest of the matrix appears generally suitable. The findings of this study could support the extension of one or two smaller sizes in some component lines to accommodate the smaller stature of East Asians. However, the implications for blacks are less clear and warrant further consideration. Poorer post-TKA outcomes for blacks have been reported in epidemiologic studies in terms of revision rates [2, 8], postoperative complications [4], mortality [9], and higher probability of discharge to institutional care (versus home care) [6]. Contributing factors may include medical complexity or comorbidity, cultural expectations, timing of referral by providers for intervention, and healthcare system mediated access [5].

Where Do We Need To Go?

Based on the findings of this systematic review, we are left with an important, but unaddressed question: Could clinical outcome differences seen in the black population be related to the sizing issues noted here? Identifying the root causes of outcome disparities between ethnic groups should be a primary concern both at the individual and population level. These disparities are almost certainly

multifactorial, and include elements of social, economic, and cultural factors, existing general health disparities, and issues with care delivery [2, 10]. I do not believe that the challenges that black patients have after TKA are a function of the AP depth of the tibial component, and the data here should not be used to justify race- or ethnicity-specific TKA implants.

How Do We Get There?

There have been several population-level attempts to identify the reasons for this poorer outcome, but clearly more needs to be done. This issue is particularly timely in this era of bundling payments and pay-per-performance. These methodologies claim to aim at improving the quality of care rendered to patients by penalizing providers for rendering care to the most at-risk patients. Little effort is directed at removing barriers to care, reducing comorbidities, and improving patient education, which may actually represent one of the greatest risks to already at-risk ethnic groups. There is a delicate balance between risk avoidance and restriction of access to care, and physicians must be resolute in maximizing the quality and accessibility of care to all patients. Steps should be taken to more clearly delineate and rectify knowledge gaps about the safety and

efficacy of surgical intervention for both patients and referring providers. Studies should assess referral rates by region and provider network to assure that referral patterns are optimized. Registry data should be reviewed for evidence of associations of race or ethnicity with specific failure mechanisms such as an increased rate of tibial loosening in blacks; such associations may not be adequately elucidated in small clinical studies or in large epidemiologic studies that lack data on failure mechanisms.

The study by Kim and colleagues does identify some racial differences in bone morphology. However, I do not believe that these differences warrant the development of separate implant systems. Rather, the differences noted remain somewhat subtle and of questionable clinical significance and can be accommodated with adaptations of the sizing matrixes of modern knee designs.

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