

The effect of obesity on mechanical failure after total knee arthroplasty

Stanislas Gunst, Michel-Henri Fessy

Hospices Civils de Lyon, Centre Hospitalier Lyon-Sud, Service de Chirurgie Orthopédique, Traumatologique et Médecine du Sport, Pierre Bénite Cedex, France

Correspondence to: Stanislas Gunst, MD, Hospices Civils de Lyon, Centre Hospitalier Lyon-Sud, Service de Chirurgie Orthopédique, Traumatologique et Médecine du Sport, Pierre Bénite Cedex, France. Email: stanislas.gunst@hotmail.fr.

Abstract: “Increased aseptic tibial failures in patients with a BMI ≥ 35 and well-aligned total knee arthroplasties” published in *The Journal of Arthroplasty* on July 2, 2015 draws the conclusion that the risk of revision total knee arthroplasties (TKA) due to aseptic tibial component loosening is two times greater in patients with a BMI ≥ 35 kg/m², independent of age or limb alignment. This result confirms that obese patients are at a higher risk of mechanical complications after performing TKA, independently from the risk of infection. This study suggests that the management of obese patients for TKA must be meticulous, careful, and should inspire from great bone deformations in valgus or varus when choosing implants.

Keywords: Obesity; total knee arthroplasty (TKA); tibial failures; aseptic loosening

Submitted Oct 20, 2015. Accepted for publication Oct 22, 2015.

doi: 10.3978/j.issn.2305-5839.2015.10.37

View this article at: <http://dx.doi.org/10.3978/j.issn.2305-5839.2015.10.37>

Knee-replacement surgery is a very frequent and highly successful procedure, with more than 600,000 arthroplasties in 2008 in the US. It relieves pain and improves knee function in people with advanced arthritis of the joint. Total knee replacement (TKR) is a successful gold standard in the treatment of end-stage degenerative joint disease or deformity of the knee. A couple long-term follow-up studies of standard total knee arthroplasty (TKA) have shown excellent results for pain reduction, functional improvement, and survivorship of 90-95% at 15 years (1,2). The prevalence of total knee arthroplasties has increased in the past 2 decades and the demand is expected to dramatically grow in the future. In the same period, the prevalence of obesity of adults also grew in occidental countries. By 2030, more than 80% of the adults are expected to be obese in the US. There are several causes of failure in TKR, and the literature is divided over the influence of obesity on outcome in these arthroplasties. Some authors found similar results for obese and non-obese patients (3-7) whereas others describe obesity as having a negative influence on outcome (7-9). Aseptic loosening of the tibial component is the most frequent cause of failure in TKR (10). Implant-bone stress levels, particularly on rather weak cancellous bone, have been implicated as the predominant cause for aseptic tibial

component loosening (11). A high body weight increases the stress transferred through a TKR to the surrounding bone (12), suggesting TKR to be associated with a poor outcome and a higher failure rate in obese patients, owing to higher peak stresses and cycle loading across the replaced joint.

In this study, based on patients undergoing primary unilateral TKR for osteoarthritis in an American institution, the team focused on risk factors for aseptic loosening of the tibia, particularly related to body mass index. Patients who underwent revision due to aseptic loosening, polyethylene wear, instability, or arthrofibrosis were excluded. Patients were stratified into six categories according to the World Health Organization: “underweight” (<18.50 kg/m²), “normal” (18.50-24.99 kg/m²), “overweight” (25.00-29.99 kg/m²), “obese class I” (30.00-34.99 kg/m²), “obese class II” (35.00-39.99 kg/m²) and “obese class III” (≥ 40 kg/m²). The overall revision rate due to aseptic tibial component loosening was 1%. Patients experiencing aseptic loosening were younger and had a higher BMI, with a risk for revision almost two times greater in those with a BMI ≥ 35 kg/m². Another study showed that focal osteolysis rates were five times higher in patients with a BMI >40 kg/m² (5). The cutoff for outcome measures in TKA is not perfectly determined yet, with studies finding differences at 30 kg/m² (9,13-16),

and others at 35 kg/m² (17,18). Ries *et al.* (19) found a greater rate of loosening of the tibia with short keels when implanted in obese patients compared to standard keels. A greater contact area between bone and implant would lead to a better repartition of stress, like in great bone deformations in valgus or varus. Surgeons should be careful when performing TKR in grade II or III obese patients, particularly concerning tibial loosening. Technical features, like the systematic use of long keels or stems might be examined in the future.

Performing TKR requires a team of medical experts, including surgeons, anesthesiologists, endocrinologists and experts from various departments. Prospective randomized trials will be needed to further demonstrate the outcome after TKR in obese patients. Meanwhile surgeons must be careful and meticulous when performing TKR, in particular concerning the choice of implants, alignment of the limb, and the risk of infection.

Acknowledgements

None.

Footnote

Provenance: This is a Guest Editorial commissioned by the Associate Editor-in-Chief Dongquan Shi, MD, PhD (Department of Sports Medicine and Adult Reconstruction, Drum Tower Hospital, Medical School, Nanjing University, Nanjing, China).

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

- Berger RA, Rosenberg AG, Barden RM, et al. Long-term followup of the Miller-Galante total knee replacement. *Clin Orthop Relat Res* 2001;(388):58-67.
- Robertsson O, Ranstam J, Sundberg M, et al. The Swedish Knee Arthroplasty Register: a review. *Bone Joint Res* 2014;3:217-22.
- Stern SH, Insall JN. Total knee arthroplasty in obese patients. *J Bone Joint Surg Am* 1990;72:1400-4.
- Smith BE, Askew MJ, Gradisar IA Jr, et al. The effect of patient weight on the functional outcome of total knee arthroplasty. *Clin Orthop Relat Res* 1992;(276):237-44.
- Spicer DD, Pomeroy DL, Badenhausen WE, et al. Body mass index as a predictor of outcome in total knee replacement. *Int Orthop* 2001;25:246-9.
- Deshmukh RG, Hayes JH, Pinder IM. Does body weight influence outcome after total knee arthroplasty? A 1-year analysis. *J Arthroplasty* 2002;17:315-9.
- Amin AK, Clayton RA, Patton JT, et al. Total knee replacement in morbidly obese patients. Results of a prospective, matched study. *J Bone Joint Surg Br* 2006;88:1321-6.
- Foran JR, Mont MA, Etienne G, et al. The outcome of total knee arthroplasty in obese patients. *J Bone Joint Surg Am* 2004;86-A:1609-15.
- Foran JR, Mont MA, Rajadhyaksha AD, et al. Total knee arthroplasty in obese patients: a comparison with a matched control group. *J Arthroplasty* 2004;19:817-24.
- Vanlommel J, Luyckx JP, Labey L, et al. Cementing the tibial component in total knee arthroplasty: which technique is the best? *J Arthroplasty* 2011;26:492-6.
- Bourne RB, Finlay JB. The influence of tibial component intramedullary stems and implant-cortex contact on the strain distribution of the proximal tibia following total knee arthroplasty. An in vitro study. *Clin Orthop Relat Res* 1986;(208):95-9.
- Morrison JB. The mechanics of the knee joint in relation to normal walking. *J Biomech* 1970;3:51-61.
- Dowsey MM, Choong PF. Obese diabetic patients are at substantial risk for deep infection after primary TKA. *Clin Orthop Relat Res* 2009;467:1577-81.
- Abdel MP, Ast MP, Lee YY, et al. All-cause in-hospital complications and urinary tract infections increased in obese patients undergoing total knee arthroplasty. *J Arthroplasty* 2014;29:1430-4.
- Bozic KJ, Lau E, Ong K, et al. Risk factors for early revision after primary TKA in Medicare patients. *Clin Orthop Relat Res* 2014;472:232-7.
- Bourne RB, McCalden RW, MacDonald SJ, et al. Influence of patient factors on TKA outcomes at 5 to 11 years followup. *Clin Orthop Relat Res* 2007;464:27-31.
- Miric A, Lim M, Kahn B, et al. Perioperative morbidity following total knee arthroplasty among obese patients. *J Knee Surg* 2002;15:77-83.
- Dowsey MM, Choong PF. Obesity is a major risk factor for prosthetic infection after primary hip arthroplasty. *Clin Orthop Relat Res* 2008;466:153-8.
- Ries C, Heinichen M, Dietrich F, et al. Short-keeled cemented tibial components show an increased risk for aseptic loosening. *Clin Orthop Relat Res* 2013;471:1008-13.

Cite this article as: Gunst S, Fessy MH. The effect of obesity on mechanical failure after total knee arthroplasty. *Ann Transl Med* 2015;3(20):310. doi: 10.3978/j.issn.2305-5839.2015.10.37