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Title

Radiological signs of osteoarthritis of hip and knee in lower limb amputees that apply for bone anchored prostheses

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Summary

Patients with a lower limb amputation who apply for a bone-anchored prosthesis (BAP) already have signs of osteoarthritis (OA) of the ipsilateral joint proximal to the amputation level. Since axial loading is restored with the BAP, we have seen that the incidence of OA slightly increases over time.

Introduction/ basics

In the pre-surgical screening of amputees applying for a Bone-Anchored Prosthesis (BAP) we have seen that quite a few subjects have shown radiological signs of probably disuse osteoarthritis (OA) of the ipsilateral joint immediately proximal to the amputation level. Since with BAP the axial loading of these joints is restored, it is important to know the clinical consequence of the radiological signs of OA and potential progression in time. The aim of this study is to determine the pre-surgical incidence of hip or knee OA in persons with a lower extremity amputation and to investigate the course of OA after implantation of a BAP.

Material method; implementation/ process

In a single-center cross-sectional study, all subjects who underwent osseointegration implant (OI) surgery between May 2009 and November 2019 were included. Patient demographics that were gathered in this study included gender, amputation side and level (transfemoral amputation (TFA) or transtibial amputation (TTA)), cause of amputation, time between amputation and implantation, and body-mass index (BMI). All individuals underwent standard anterior-posterior and lateral conventional radiographs prior to surgery and at 1, 2 and 5 year follow-up. Two independent raters, (JM and AW) used the Kellgren-Lawrence (KL) classification (grade 1-4) to grade the level of OA of the hip or knee of the residual limb (table

1). A consensus meeting was held to finalize an unanimous definitive list. Prevalence of OA, defined as a KL classification grade of 2 or higher, was compared at baseline and at 1, 2 and 5 years follow-up. Cohens Kappa was used to measure the inter-rater reliability.

Results

Hundred-ninety-four of 201 eligible patients were included of which 72% were male (table 2). One-hundred-forty-four (74%) patients were treated with a TFA OI, fifty (26%) with a TTA OI and 2 (1%) were treated with both a TFA and TTA implants. Mean time between amputation and OI surgery was 15.5 -years and 11.9-years for transfemoral and transtibial amputees, respectively. Of the 144 transfemoral amputees 60% (87/144) had radiological signs of hip OA prior to OI surgery. At 1-, 2-, and 5-years post-BAP surgery, prevalence of OA of the hip was 66% (92/139); 69% (75/109); and 68% (50/74), respectively. In the transtibial group 50% (25/50) had OA of the knee pre-bap surgery. At 1-, 2-, and 5-years post-BAP surgery, prevalence of OA of the knee was 51% (23/45); 61% (14/23); and 63% (5/8). One patient underwent hip resurfacing surgery because of severe hip OA. Inter-rater Cohens Kappa was 0.56 (considered as moderate) with a percent agreement of 78%.

Discussion/ conclusion; conclusion for the practice

In this study it is shown that radiological signs of OA are a common incidental finding in the pre-OI surgical diagnostics and in time it appears that the number of subjects with radiological signs of OA slightly increases. However, it is not known whether these radiological signs of AO have any clinical consequences. Further research is needed to evaluate the relation between radiologic signs and clinical symptoms.

References

1. Struyf PA, van Heugten CM, Hitters MW, Smeets RJ. The prevalence of osteoarthritis of the intact hip and knee among traumatic leg amputees. Arch Phys Med Rehabil. 2009;90(3):440-6.
2. Kohn MD, Sassoon AA, Fernando ND. Classifications in Brief: Kellgren-Lawrence Classification of Osteoarthritis. Clin Orthop Relat Res. 2016;474(8):1886-93.

Image: Table 1 Kellgren Lawrence classification_166.png

Table 1 Kellgren Lawrence classification

Grade	Radiologic findings
1	Doubtful narrowing of the joint space with possible osteophyte formation
2	Possible narrowing of the joint space with definitive osteophyte formation
3	Definite narrowing of joint space, moderate osteophyte formation, some sclerosis, and possible deformity of bony ends
4	Large osteophyte formation, severe narrowing of the joint space with marked sclerosis, and definite deformity of bone ends

Image: Table 2 Patient demographic_167.png

Table 2 Patient demographic

	Total (N=194)	TFA (N=144)	TTA (N=50)
Male (%)	72	69	41
Cause of amputation (%)	Trauma: Vascular: Infection: Tumor: Other:	Trauma: 60 Vascular: 10 Infection: 12 Tumor: 7 Other: 11	Trauma: 58 Vascular: 14 Infection: 16 Tumor: 2 Other: 10
Mean BMI (kg/m ²) + SD	26.1 + 5.1	26.1 + 4.3	26.2 + 6.9
Mean time between amputation and implantation + SD (years)	14.6 + 13.9	15.5 + 14.9	11.9 + 6.9
Mean age at implantation + SD (years)	52.8 + 13.6	53.8 + 13.8	50.1 + 12.8
Kellgren-Lawrence scale pre-BAP surgery (%)	0: 7 1: 36 2: 47 3: 11 4: 1	0: 6 1: 36 2: 47 3: 13 4: 1	0: 10 1: 40 2: 48 3: 2 4: 0
Kellgren-Lawrence scale at 1-year post-op (%)	0: 4 1: 30 2: 49 3: 1 4: 1	0: 3 1: 29 2: 50 3: 13 4: 1	0: 6 1: 38 2: 44 3: 2 4: 0
Kellgren-Lawrence scale at 2-year post-op (%)	0: 6 1: 26 2: 52 3: 16 4: 1	0: 2 1: 20 2: 38 3: 13 4: 1	0: 8 1: 10 2: 24 3: 4 4: 0
Kellgren-Lawrence scale at 5-year post-op (%)	0: 2 1: 27 2: 48 3: 20 4: 0	0: 1 1: 13 2: 24 3: 11 4: 0	0: 0 1: 6 2: 8 3: 2 4: 0