Reviewer's report

Title: The implications of 18F-FDG PET for the diagnosis of endoprosthetic loosening and infection in hip and knee arthroplasty: Results from a prospective, blinded study

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Reviewer: Patrick Reinartz

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General

The paper by Delank et al. analyzes the potential of positron emission tomography (PET) to diagnose and differentiate the two most common complications of joint replacement, loosening and infection. To this end, a total of 27 patients with 36 hip and knee prostheses were included in the study. In addition to the PET scans, a bone scintigraphy was acquired in 28 of the 36 prostheses (77.8%). Diagnostic reference of the study were the results of surgical intervention (27/36) or clinical examination (9/36). Five of the joint replacements turned out to be infected while 31 of the prosthetic components were loosened (proximal component: 16 cases, distal component: 15 cases).

The PET scans were analyzed qualitatively and quantitatively. While the quantitative approach using standard uptake values was able to reliably identify pathological processes, it showed substantial limitations in differentiating loosening from septic or aseptic infection. Under utilization of qualitative criteria, loosening was correctly diagnosed in 76.4% by PET and in 75% by bone scan. In contrast, septic infection could be diagnosed correctly by PET in 100% whereas bone scintigraphy proved to be largely ineffective.

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Major Compulsory Revisions (that the author must respond to before a decision on publication can be reached)

1. While the criteria for the qualitative interpretation of the PET acquisitions are given in detail (Fig. 1), no such thing can be found for the bone scan. A corresponding amendment should be made. Furthermore, it should be mentioned on page 6 (Materials and Methods) that the bone scans were acquired in triple-phase technique.

2. The qualitative criteria for the diagnosis of pathological processes of joint replacements described in the paper by Reinartz et al. were developed exclusively for hip arthroplasty. This limitation should be mentioned in the text. So far, our group has scanned about 60 painful knee prostheses. In contrast to hip arthroplasty, we were unable to find any consistent criteria for the loosening of knee prostheses. Only the criterion for an infection of the prosthesis could be verified. In this context, it should be mentioned how many hip prostheses and how many knee prostheses were included in the study. Furthermore, both subgroups should be tested separately. It would be of great interest whether the accuracy of PET imaging is comparable for hip as well as knee arthroplasty or whether results are discrepant.

3. The relatively low accuracy of PET in detecting prosthetic loosening is explained by the lack of cellular elements in the region between the cemented bed and the prosthesis. Were all joint replacements cemented? If so, it should be stated, if not, the exact number of cemented and cementless prostheses should be given. In this context, it would be of interest to test whether the type of implantation (cemented vs. cementless) has an impact on the imaging results.
Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

1. On page 2, the word "microbiologic" should be replaced by "microbiological".
2. The name of the author cited on page 3 is "Cremerius" instead of "Cremius".
3. The formula for the calculation of the SUV is incorrect. The denominator should read (decay corrected injected dose [Bq] x body weight [kg]) instead of (decay corrected injected dose [Bq] / body weight [g]).
4. On page 5, second paragraph, and on page 8, last paragraph, the word prosthesis is used in singular instead of plural (prostheses).
5. In Table 1, the first column of the last row reads "Not loosened component" instead of "No loosened component".
6. Some of the references are not cited according to the journal's style. This should be corrected.
7. The citation of the paper by Reinartz et al. is incorrect. The authors should be named in the following order: Reinartz P, Mumme T, Hermanns B, Cremerius U, Wirtz DC, Schaefer WM, Niethard F-U, Buell U. The citation given in the manuscript is based on the erroneous data set entry of the Medline, which hopefully will be corrected soon.

Discretionary Revisions (which the author can choose to ignore)

What next?: Accept after minor essential revisions
Level of interest: An article of importance in its field
Quality of written English: Acceptable
Statistical review: No
Declaration of competing interests:
I declare that I have no competing interests.