Proposed Classification System of Radiographic Bone Changes after Cervical Disc Replacement

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INTRODUCTION:

Cervical disc replacement (CDR) is an increasingly utilized procedure to address cervical degenerative conditions, as an alternative to discectomy and fusion, for the purpose of preserving natural segmental motion. Radiographic bone changes are a common observation around hip and knee arthroplasty as well as with CDR prosthesis. Historically, classification systems have been common tools used to assist communication and perioperative evaluation, as well as to provide guidance for potential treatment options. A classification system with a common nomenclature for radiographic observations of periprosthetic bone changes following CDR is proposed.

METHODS:

A panel of experts was assembled for the purpose of creating a classification system for radiographic observations. Using serial radiographs from patients, a classification system has been proposed to aid in reproducibly and consistently identifying bony changes and assessing CDR device radiographic appearance.

Subdividing the superior and inferior vertebral bodies into 3 equal sections (anterior, middle, posterior), observed bone loss is recorded. Bone loss categories include endplate rounding, cystic “rat bite” erosion adjacent to the endplate with diffuse and/or sclerotic margins, and cystic bone loss not adjacent to the endplate. Determining if the bone loss is progressive is also informative, as well as estimating a measure of severity of the bone loss. Severity of bone loss is measured by the percentage of the end plate involved.

Additional bony changes that may be relevant in the assessment of the radiographic appearance and device performance include progressive or non-progressive radiolucent lines (with and without sclerotic margins), as well as heterotopic ossification (HO), using the McAfee classification system. Other important radiographic observations recorded include loss of core implant height and the presence or absence of device migration, subsidence, and olisthesis.

RESULTS:

Serial radiographs from 15 patients implanted a minimum of 48 months (most implanted at least 60 months) with single level CDR were assessed by 6 investigators including clinicians and scientists experienced in CDR or appendicular skeleton joint replacement to develop an accurate and reproducible classification scheme. After several iterations, a classification system emerged that had improved concordance among the participating investigators, with superior vertebral bone loss and subsidence having the highest correlation. Next steps include assessing reliability with a broad group of clinicians and scientists, using serial radiographs from a significant number of patients, to confirm the proposed classification scheme.

DISCUSSION AND CONCLUSION:

A standardized nomenclature for bony changes following CDR will be useful to facilitate accurate and reproducible scientific communications regarding the clinical outcomes of this procedure. The novel system proposed here demonstrated good concordance among experienced investigators in this field and represents an important advancement.