

# INTERPRETATION BY RADIOLOGISTS OF ORTHOPEDIC TOTAL JOINT RADIOGRAPHS: IS IT NECESSARY OR COST-EFFECTIVE?

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**OBJECTIVE:** To examine the necessity and cost-effectiveness of interpretation by radiologists of orthopedic radiographs obtained for patients who undergo total hip or knee replacement.

**DESIGN:** A prospective study. Serial preoperative and postoperative x-ray films of the joint in patients scheduled to undergo total hip or knee joint replacement during one calendar year were interpreted by both radiology and orthopedic department staff and compared. Intraoperative findings were used to confirm the radiologic interpretation. The follow-up was 1 year.

**SETTING:** A university teaching hospital.

**INTERVENTIONS:** Primary or revision total hip or knee replacement.

**MAIN OUTCOME MEASURES:** Differences in interpretation of radiographs by radiologists and orthopedic surgeons for any of the four procedures. A change in orthopedic management.

**RESULTS:** For preoperative radiographs, there were no discrepancies between the radiologists and orthopedic surgeons with respect to primary joint replacement. For 100 revision procedures there were 15 discrepancies, but in all cases the orthopedic surgeon's interpretation proved to be correct. For the postoperative radiographs, there were no discrepancies in the group of revision hip replacements. For the other three groups there were a total of six discrepancies and in all cases the orthopedic surgeon's interpretation was correct. In two cases conditions were present that were not recognized by staff from either the radiology department or orthopedic department.

**CONCLUSION:** Interpretation by radiologists of total joint radiographs in patients who undergo primary or revision total hip or knee replacement arthroplasty is not necessary or cost-effective.

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**OBJECTIF :** Examiner la nécessité et l'efficacité du coût de l'interprétation, par des radiologistes, de radiographies orthopédiques de patients qui subissent une arthroplastie totale de la hanche ou du genou.

**CONCEPTION :** Étude prospective. Des séries de radiographies préopératoires et postopératoires de l'articulation de patients devant subir une arthroplastie totale de la hanche ou du genou pendant une année civile ont été interprétées par le personnel du département de radiologie et du département d'orthopédie, et comparées. On a utilisé des constatations intra-opératoires pour confirmer l'interprétation radiologique. Il y a eu au total 524 arthroplasties totales de la hanche ou du genou. Le suivi a été d'un an.

**CONTEXTE :** Hôpital d'enseignement universitaire.

**INTERVENTIONS :** Arthroplastie totale primaire ou secondaire de la hanche ou du genou.

**PRINCIPALES MESURES DES RÉSULTATS :** Écart au niveau de l'interprétation des radiographies par des radiologistes et des chirurgiens orthopédistes dans le cas de n'importe laquelle des quatre interventions. Changement du traitement orthopédique.

**RÉSULTATS :** Dans le cas des radiologies préopératoires, on n'a enregistré aucun écart entre les radiologistes et les chirurgiens orthopédistes pour ce qui est de l'arthroplastie primaire de l'articulation. On a enregistré 15 écarts sur 100 interventions de révision, mais dans tous les cas, l'interprétation du chirurgien orthopédiste s'est révélée correcte. Dans le cas des radiographies postopératoires, on n'a enregistré aucun

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écart dans le groupe des sujets qui ont subi une arthroplastie de révision de la hanche. Dans celui des trois autres groupes, on a enregistré au total six écarts et dans tous les cas, l'interprétation du chirurgien orthopédiste était correcte. Dans deux cas, les sujets avaient un problème qui n'a pas été reconnu par le personnel du département de radiologie ni par celui du département d'orthopédie.

CONCLUSION : L'interprétation de radiographies totales de l'articulation chez les patients qui subissent une arthroplastie totale primaire ou secondaire de la hanche ou du genou n'est pas nécessaire ni efficace sur le plan des coûts.

The changing environment of health care economics has forced health care workers, including orthopedists, to examine practices that have become "routine" and to increase cost-effectiveness while maintaining standards. In anticipation of the need for further cost-saving measures we questioned one of our procedural practices: the routine interpretation by radiologists of orthopedic radiographs obtained preoperatively and postoperatively in patients who undergo total joint replacement. We posed three questions:

- Does routine interpretation of preoperative and postoperative x-ray films by radiologists change the orthopedic management of a patient who undergoes total joint replacement?
- Are there discrepancies between the orthopedist's and radiologist's interpretation of orthopedic radiographs?
- What is the cost of having the radiologist make this interpretation and is it cost-effective?

## METHODS

It is the policy in our health care practice, as is the case in most centres in North America, that the review of orthopedic x-ray films by radiologists is not required in an office-based practice but is required in a hospital-based practice. It is the policy of our institution that all radiography must be performed by the radiology department and it is the policy of the radiology department that all x-ray films be interpreted and the fee for this interpretation be billed by the radiologist. Only orthopedic films were included in the

study. We acknowledge that many of our patients may have had concurrent medical problems requiring the assistance of specific radiologic and medical subspecialty services.

Because a patient may have had more than one joint replacement, in this paper we refer to the numbers as cases rather than patients. Five hundred and twenty-four primary or revision total hip or knee joint replacements done during 1992 were included. The patients were under the care and supervision of two experienced joint replacement surgeons in a teaching hospital-based practice. Clinical data were collected prospectively and compared retrospectively. Orthopedic assessment was performed by orthopedic residents, fellows and consultants of University Hospital, University of Western Ontario, London, Ont., and their observations were recorded in the clinic note as part of the patient's routine assessment. All radiographs were interpreted by staff on the orthopedic service as well as by the radiology department staff under the supervision of general radiology consultants.

Sequential orthopedic radiographs were obtained preoperatively, immediately postoperatively and at 6 weeks, 3 months, 6 months and 1 year. 1992 was chosen as the index year so that patients would have been followed up for at least 1 year postoperatively.

There is no separate fee for the orthopedic interpretation of radiographs when they are obtained in a hospital-based practice. In terms of the radiologist's fee for interpreting a radiograph, there is a "technical" component and

a "professional" component as outlined in the schedule of fees published by the Ontario Health Insurance Plan for medical procedures.<sup>1</sup> The technical component of the fee incorporates the performance of the diagnostic procedure, preparing the patient for the procedure and providing the premises, the equipment and supplies for the procedure. The professional component of the fee includes the interpretation of the results of the diagnostic procedure.

## RESULTS

Of the 524 replacements, eight records were incomplete and were excluded. We included all replacements for which there was at least 1 year of postoperative follow-up even if the patient did not attend one of the interval visits.

There were 240 primary total knee replacements and 184 primary total hip replacements, 55 revision total knee replacements and 45 revision total hip replacements.

### Primary total knee replacement

Of the 240 primary total knee replacements, there was no discrepancy between the orthopedist's and radiologist's interpretation of preoperative x-ray films, nor was there any change in treatment (reoperation) as a result of the radiologist's interpretation. On the postoperative films, the orthopedic staff noticed a subluxed polyethylene spacer in one case requiring that the patient undergo revision to a thicker spacer. The radiologist did not interpret the subluxation of the

spacer. Another patient underwent revision for ongoing pain. A loose femoral component was noted at revision but had not been recognized on preoperative radiographs by either the orthopedist or radiologist.

**Primary total hip replacement**

Of 184 primary total hip replacements, there was no discrepancy between the orthopedist's and radiologist's interpretation of preoperative radiographs, nor were there any changes in treatment as a result of the radiologist's interpretation. Of all the postoperative x-ray films in this group, the radiologist's interpretation in five cases differed from the orthopedic assessment: one case involved suspicion of a fracture inferomedial to the acetabular component, one case of possible acetabular component loosening and two cases of possible femoral loosening immediately postoperatively. The orthopedic department interpreted these five radiographs as satisfactory, the patients were asymptomatic and there was no change in management. The orthopedists noted one case of a loose femoral component with subsidence 3 months postoperatively. This was interpreted as "no change" by the radiologist. However, this patient was symptomatic and in pain and underwent revision of the femoral component at which time the loosening was confirmed.

**Revision knee replacement**

Of the 55 revision total knee replacements there were 12 cases of discrepancy between the radiologist's and the orthopedist's interpretation. These cases included orthopedic interpretation of patellar polyethylene wear or tibial polyethylene wear, or both. The radiologists interpreted the preoperative radiographs as satisfactory.

In all cases the patients were symptomatic and required revision of the patellar component alone, the patellar and tibial polyethylene spacer, or complete knee revision.

On the postoperative radiographs, the radiologists interpreted one case as having possible loosening around the medial tibial plateau whereas the orthopedist's interpretation was "satisfactory." The patient was asymptomatic and there was no change in management. Another case of a patient having a quadriceps rupture 3 months postoperatively was not recognized by the orthopedic or radiology department and the patient subsequently required reoperation for quadriceps repair. The preoperative radiograph, in retrospect, did not show any evidence of an abnormality.

**Revision hip replacement**

Of the 45 revision hip replacements, there were three cases in which there was a discrepancy on the preoperative radiographs. They included one case of acetabular loosening, one case of femoral loosening and one case of both femoral and acetabular loosening. In all three cases the orthopedists diagnosed loosening but the radiologists did not. All three cases were symptomatic and the patients underwent revision, at which time the diagnosis was confirmed. There were no discrepancies with respect to the postoperative radiographs.

**Costs**

For a standard anteroposterior pelvis and lateral radiograph of one hip, the technical fee was \$27.77 Canadian and the professional fee \$7.67 Canadian. For standing anteroposterior, lateral and axial patellofemoral knee radiographs the technical fee was \$22.94 Canadian and the professional fee

\$7.50 Canadian. The professional fees for radiologists' interpretation of the x-ray films in this study totalled approximately \$23 000 for the study period.

**DISCUSSION**

In 516 consecutive joint replacement procedures, the interpretation of orthopedic x-ray films by radiologists did not change the orthopedic management of any patient. On the other hand, there were two cases in the postoperative period in which the orthopedists' interpretation was different from the radiologists' and resulted in a change of management for the patient. Another two cases involved a failure of orthopedists as well as radiologists to interpret the findings on the postoperative radiographs, which resulted in a change of management for the patient. When we considered revision of joint replacement, however, the radiologist did not recognize 15 out of 100 knee and hip replacements that had radiographic findings requiring revision procedures. The orthopedic interpretation of the radiographs was the basis for revision and was confirmed by intraoperative findings.

At the time this study was done it was the authors' practice to obtain sequential x-ray films on patients at each follow-up visit, namely at 6 weeks, 3 months, 6 months and yearly thereafter. As a result of this study, this practice has been reassessed and the 6-week film is no longer ordered, nor is the 6-month film if the patient is asymptomatic. However, we feel strongly that serial radiographs should be performed in conjunction with clinical assessment of patients at annual follow-up visits. The radiographic sequelae of total joint replacement often precede the clinical findings, and it is necessary to document and sometimes to interfere before these changes have an adverse effect on the patient. Thus,

even though it may appear excessive to collect a large number of "normal" postoperative radiographs, nevertheless, a baseline is established for comparison with future radiographs.

It has been suggested that one of the values of having a radiologist interpret total joint radiographs relates to a reduction in number of law suits for orthopedists. Our data, however, suggest the opposite, particularly as it relates to the interpretation of radiographs in patients scheduled for revision hip or knee replacement. The radiologists in this study did not recognize the radiographic indications for revision in 15% of patients who required revision, a fact that could increase the exposure of radiologists to law suits. Although it is true that the radiologists did not have the benefit of clinical examination in any of these cases, this fact is applicable in virtually all situations where radiologists are interpreting ordinary x-ray films. It is important to point out that our findings may not be applicable to all institutions doing total joint replacement, particularly with respect to orthopedic interpretation. The senior authors (C.H.R. and R.B.B.) have subspecialty practices doing nothing but adult hip and knee reconstructive surgery. The radiologists interpreting the radiographs, on the other hand, were general radiologists and, therefore, were probably not dissimilar from most general radiologists reading x-ray films in other institutions in Canada.

Over the last few years there have been a few reports examining the routine radiologic interpretation of x-ray films for patients who undergo orthopedic procedures under the care of an orthopedic surgeon. Clark and associates<sup>2</sup> found that in 226 implant cases the radiology report did not contain sufficient information to be used clinically, thus requiring the orthopedist to interpret the radiographs directly in

order to provide patient care. Bosse, Brumback and Hash<sup>3</sup> reported on patients with multiple trauma associated with orthopedic injuries and concluded that radiologists' readings of x-ray films were 94% to 96% correct on retrospective and prospective radiographs and did not alter the orthopedic management of the patients. De Araujo and associates<sup>4</sup> reported on the treatment of 300 fractures and recommended that elimination of the radiologists' reading of the follow-up films would reduce the cost of fracture care up to 8% without altering patient outcome. The elimination of the routine and redundant practice of having radiologists interpret emergency room x-ray films has also been recommended by the Office of Inspector General of the United States Department of Health and Human Services.<sup>5</sup>

It would be expected that the technical component of radiography for the purpose of managing a patient in the perioperative period of the total joint replacement would be a fixed cost regardless of whether the orthopedist or the radiologist, or both, interpreted the radiographs. In our study, the interpretation of orthopedic radiographs by a radiologist for an individual patient who underwent total joint replacement did not change that patient's management. The total added cost for this redundant interpretation of orthopedic x-ray films in terms of the professional fee was approximately \$23 000 during the 1 year of the study.

The findings of our study confirm those in previously presented studies that the routine interpretation of orthopedic x-ray films by radiologists does not alter the management of a patient who undergoes a primary or revision total joint replacement. Furthermore, radiologists' interpretations of preoperative films were less accurate than the orthopedists' interpreta-

tions. The current routine practice of having radiologists interpret orthopedic total joint radiographs was not necessary and, therefore, not cost-effective. We agree with Bosse, Brumback and Hash<sup>3</sup> that "if the subspecialist is credentialed to interpret the radiographs specific to his specialty and the reading is documented in the record, redundant reading by the radiologist and compounding of professional fees may be unwarranted." If this routine practice is eliminated, the potential savings of health care dollars in Canada would be considerable, based on the estimated number of 50 000 total hip and total knee replacements performed annually.

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