

# Working toward reducing postoperative fracture radiographs: a survey of Canadian surgeons

Ted Tufescu, MD

Accepted for publication  
Sept. 18, 2015

**Correspondence to:**

T. Tufescu  
Department of Surgery  
University of Manitoba  
401-820 Sherbrook Ave.  
Winnipeg MB R3A 1R9  
ttufescu@hsc.mb.ca

DOI: 10.1503/cjs.005715

**Background:** When fracture management includes operative fixation with a load-sharing construct in good-quality bone, screening for healing problems or hardware failure with radiographs in the first 6 postoperative weeks may be unnecessary. I sought to determine Canadian orthopedic surgeons' current protocol for early postoperative radiographs of stable, internally fixed fractures as well as their willingness to adopt a simplified protocol.

**Methods:** Members of the Canadian Orthopaedic Association were surveyed electronically. Five examples of surgically treated fractures were chosen to represent the spectrum of load-sharing constructs. The survey collected demographic data and inquired about current postoperative radiograph protocols and consideration of a simplified protocol.

**Results:** Of the 822 emailed invitations to complete the survey, 400 were opened and 243 surveys were completed. Most participants (91%) practised in Canada and managed some trauma (91%), but were not trauma specialists (82%). Surgeon experience was equally distributed. Sixty-six percent of respondents acquire immediate postoperative radiographs after femur and tibia intramedullary nails, and 62% repeat radiographs at 2-week follow-up. Fifty-one percent of respondents acquire immediate postoperative radiographs after forearm, humerus and ankle internal fixation, and 69% repeat radiographs at 2-week follow-up. Of the respondents who currently acquire radiographs, 33% would consider foregoing immediate postoperative radiographs after intramedullary nailing of femur and tibia fractures, while 25% would forego them at 2-week follow-up. Similarly, 58% would consider foregoing radiographs immediately after internal fixation of forearm, humerus and ankle fractures, while 24% would forego them at 2-week follow-up.

**Conclusion:** Many Canadian orthopedic surgeons do not acquire screening postoperative radiographs after stable fracture fixation, and many more are willing to adopt this practice. These findings support investigating the safety and cost-effectiveness of a simplified postoperative radiographic protocol.

**Contexte :** Lorsqu'une fracture est prise en charge par fixation peropératoire au moyen d'une structure répartissant les charges dans un os de bonne qualité, il peut être inutile d'effectuer des radiographies pour dépister les problèmes de consolidation ou les défaillances matérielles dans les 6 semaines suivant l'intervention. J'ai voulu déterminer le protocole actuellement utilisé par les chirurgiens orthopédistes canadiens quant aux radiographies effectuées peu après une opération de fracture stabilisée par fixation interne, ainsi que la volonté des chirurgiens d'adopter un protocole simplifié.

**Méthodes :** Un sondage électronique a été envoyé aux membres de l'Association canadienne d'orthopédie; 5 exemples sélectionnés de fractures traitées par chirurgie y ont été utilisés pour représenter l'éventail de structures répartissant les charges. Des données démographiques ont été recueillies dans le sondage, qui comportait des questions sur les protocoles actuels de radiographie postopératoire et la prise en considération d'un protocole simplifié.

**Résultats :** Sur les 822 courriels d'invitation, 400 ont été ouverts; 243 personnes ont répondu au sondage. La plupart des répondants exerçaient au Canada (91 %) et prenaient en charge certains cas de traumatologie (91 %), mais n'étaient pas traumatologues (82 %). L'échantillon était composé de chirurgiens possédant divers degrés d'expérience selon une répartition homogène. Parmi les répondants, 66 % font une radiographie postopératoire immédiatement après l'enclouage centromédullaire de

fractures du fémur et du tibia, et 62 %, une autre radiographie lors d'un suivi 2 semaines plus tard. En outre, 51 % des répondants font une radiographie postopératoire immédiatement après fixation interne de fractures de l'avant-bras, de l'humérus et de la cheville, et 69 %, une autre radiographie lors du suivi 2 semaines plus tard. Parmi les répondants qui font actuellement des radiographies, 33 % envisageraient d'y renoncer immédiatement après l'enclouage centromédullaire de fractures du fémur et du tibia, tandis que 25 % y renonceraient lors du suivi 2 semaines suivant l'intervention. De façon similaire, 58 % envisageraient de renoncer à la radiographie immédiate après fixation interne de fractures de l'avant-bras, de l'humérus et de la cheville, tandis que 24 % y renonceraient lors du suivi 2 semaines plus tard.

**Conclusion :** Bon nombre de chirurgiens orthopédistes canadiens ne procèdent pas à une radiographie postopératoire de dépistage après stabilisation d'une fracture par fixation, et de nombreux autres seraient prêts à emboîter le pas. Ces résultats sont en faveur de l'étude de la sécurité et du rapport coût-efficacité associés à un protocole de radiographie postopératoire simplifié.

Orthopedic surgeons frequently rely on radiographs for fracture diagnosis and thereafter for monitoring the progression of fracture healing. When fracture management includes operative fixation with a load-sharing construct in good-quality bone, screening for healing problems or hardware failure with radiographs in the first 6 postoperative weeks may be unnecessary.

For fractures treated with anatomic open reduction, compression and rigid internal fixation with a plate and screw construct, primary bone healing is expected.<sup>1-3</sup> Investigators who have studied fractures treated in this fashion have expressed an inability to see any meaningful changes on radiographs obtained in the first 6 weeks after operative compression of the fracture.<sup>4,5</sup> Evidence from animal models further demonstrates that compression is maintained across the fracture by the plate and screw construct over the course of 6 weeks.<sup>2</sup> The implants themselves rarely seem to fail during this period,<sup>4,6</sup> and when they do, such failure, whether gradual or catastrophic, does not go undiagnosed owing to associated symptomatology to guide radiograph acquisition.<sup>5</sup>

Similarly, for fractures treated with locked intramedullary nails where secondary bone healing is expected, in the majority of patients, callus is not visible on radiographs until after 6 weeks.<sup>7</sup> Biomechanically, intramedullary nails have high fatigue strength compatible with supporting full weight bearing for well over 6 weeks, even in patients with comminuted fractures.<sup>8,9</sup> In clinical cohorts nails do not fail, even with unrestricted activity,<sup>8,9,11</sup> over the initial 6 weeks without a significant traumatic event.<sup>10</sup>

The literature therefore suggests that when fractures in good-quality bone are treated with compression plating and intramedullary nails, routine radiographs obtained in the first 6 weeks postoperatively do not inform the surgeon regarding healing progression and are unlikely to demonstrate or prevent problems with the implants. Omitting these radiographs may provide cer-

tain efficiencies for orthopedic surgeons and their patients. It is unclear how frequently these radiographs are currently part of surgical practice. The objective of this study was to describe Canadian orthopedic surgeons' practice patterns with respect to screening radiographs in the first 6 postoperative weeks.

## METHODS

Five fractures and fixation types were selected to represent a spectrum of load-sharing constructs in both the upper and lower extremities. I selected noncomminuted fractures (with at most 1 butterfly fragment) involving the humerus shaft and/or the forearm to represent upper-extremity fractures treated with the lag screw technique and neutralization plating, or compression plating alone. I selected mid-shaft fractures of the tibia and femur to represent lower-extremity fractures treated with locked intramedullary nails. In addition, I chose noncomminuted ankle fractures to represent a common lower-extremity fracture, usually accompanied by weight bearing restrictions. Inclusion of ankle fractures into the survey would therefore explore surgeons' approaches to a broader spectrum of injuries.

An electronic survey was created to describe these 5 types of fractures and fixation types. The first part of the survey collected surgeons' demographic data. The second part asked participants their current protocol for the acquisition of postoperative screening radiographs immediately after surgery while the patient is still in hospital as well as at the 2-week follow-up visit in clinic. Participants were asked to assume that adequate intraoperative fluoroscopy images had been acquired. Finally, participants who routinely acquire screening radiographs in hospital and at the 2-week follow-up visit were asked whether they would consider changing their practices to a simplified protocol. This protocol involved acquisition of radiographs at those time points only in the presence of a clinical indication.

The University of Manitoba Ethics Review Board approved the study protocol, and the Canadian Orthopaedic Association (COA) distributed the survey by email to its members.

I used descriptive statistics to analyze the data.

## RESULTS

The COA distributed 822 invitations by email to its members. Of these, 400 were opened. A total of 243 surgeons followed the link and completed the survey. The majority of surgeons were practising in Canada (91%) and managed some trauma (91%), but were not dedicated trauma specialists (82%). Surgeons of all experience levels were equally represented, with 23% having 0–5 years of experience, 23% having 5–10 years, 26% having 10–20 years and 29% having more than 20 years of experience.

Sixty-six percent of respondents currently acquire immediate postoperative radiographs for femur and tibia fractures treated with intramedullary nails, and 62% repeat radiographs at 2-week follow-up. Fifty-one percent of respondents currently acquire immediate postoperative radiographs for forearm, humerus and ankle fractures treated with open reduction and internal fixation, and 69% repeat radiographs at 2-week follow-up.

Of the respondents who currently acquire radiographs, 33% reported they would consider foregoing immediate postoperative radiographs after intramedullary nailing of femur and tibia fractures, whereas 25% would consider foregoing these radiographs at the 2-week follow-up. In the group currently acquiring radiographs, 58% would consider foregoing radiographs immediately after open reduction and internal fixation of forearm, humerus and ankle fractures, whereas 24% would consider foregoing radiographs at the 2-week follow-up.

## DISCUSSION

This survey shows that a relatively large proportion of orthopedic surgeons currently do not feel that screening radiographs are needed in the first weeks after fixation of fractures for which a load-sharing construct is used. Approximately one-third of surgeons already do not acquire screening radiographs in their practices, while approximately one-quarter to one-half of those who do would consider a change in practice to a simplified radiographic protocol.

## CONCLUSION

This work supports further investigation into the safety and associated cost savings of implementing a simplified postoperative radiographic protocol for fractures treated with a load-sharing construct. A randomized controlled trial comparing the use of postoperative screening radiographs to the use of such radiographs only when clinically indicated for the treatment of the fractures and fixation types outlined in this study would provide important data that could change orthopedic practice across Canada, maintaining safety and quality of care, while reducing costs for institutions and radiation exposure for patients.

**Affiliation:** From the Department of Surgery, University of Manitoba, Winnipeg, Man.

**Competing interests:** None declared.

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