

# Bilateral total knee arthroplasty — staged or simultaneous? Ontario's orthopedic surgeons reply

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**Background:** Total knee replacement is now the most common joint replacement procedure performed in Ontario, and many patients require bilateral replacement. However, whether bilateral total knee arthroplasty (TKA) should be staged or simultaneous is hotly debated. To determine the current common operative practices of orthopedic surgeons in Ontario, we carried out a province-wide survey. **Methods:** Orthopedic surgeons from Ontario listed in the 1999 *Canadian Medical Directory* or the membership list of the Canadian Orthopaedic Association were sent questionnaires, asking about their practice in the timing of bilateral TKA, tourniquet use, type of guide and use of techniques to minimize fat embolization. **Results:** Of the 416 surveys mailed, 219 (53%) surgeons responded. The majority responded that they perform staged bilateral TKA (28% 3-mo interval and 37% 6-mo interval). Simultaneous TKA with 2 teams was the least performed procedure (2%). When performing bilateral TKA, 95% of surgeons use an intramedullary femoral alignment guide, 78% utilize an over-reamed entry hole and 53% suction the canal before inserting the guide rod. With respect to the tibia, 32% use an intramedullary guide, 60% over-ream the entry hole and 60% suction the entry hole; 22% of surgeons stated that they had never considered over-reaming or suctioning the canal to minimize fat embolization. **Conclusions:** There is no consensus regarding the timing of bilateral TKA in Ontario. Furthermore, many surgeons are not overdrilling or suctioning the femoral canal despite evidence in the literature that overdrilling may be beneficial in decreasing fat embolization. Further research is required to compare the risk of complications of bilateral TKA after staged versus simultaneous TKA.

**Contexte :** L'arthroplastie totale du genou est maintenant l'arthroplastie la plus courante pratiquée en Ontario et beaucoup de patients ont besoin d'une intervention bilatérale. La question de savoir si l'arthroplastie totale du genou (ATG) bilatérale peut être réalisée en deux temps ou simultanément soulève toutefois des débats animés. Afin de déterminer les pratiques opératoires communes et courantes des chirurgiens orthopédistes de l'Ontario, nous avons procédé à un sondage provincial. **Méthodes :** On a envoyé aux chirurgiens orthopédistes de l'Ontario figurant dans l'édition 1999 du *Répertoire des médecins canadiens* ou sur la liste des membres de l'Association canadienne d'orthopédie des questionnaires portant sur la pratique relative à l'exécution d'ATG bilatérales, l'utilisation du tourniquet, le type de tige de guidage et l'utilisation de techniques visant à réduire le plus possible la formation d'embolies graisseuses. **Résultats :** Sur les 416 questionnaires envoyés à des chirurgiens, on a obtenu 219 réponses (53 %). La majorité ont répondu qu'ils procèdent à des ATG bilatérales décalées (28 % à des intervalles de trois mois et 37 % à des intervalles de six mois). L'ATG simultanée pratiquée par deux équipes constituait l'intervention la moins fréquente (2 %). Lorsqu'ils pratiquent une ATG bilatérale, 95 % des chirurgiens utilisent un guide d'alignement fémoral intramédullaire, 78 % utilisent un orifice d'entrée surdimensionné et 53 % succionnent le canal avant d'y introduire la tige de guidage. En ce qui concerne le tibia, 32 % utilisent un guide intramédullaire, 60 % surdimensionnent l'orifice d'entrée et 60 % le succionnent, 22 % des chirurgiens ont déclaré qu'ils n'avaient jamais envisagé de surdimensionner l'orifice d'entrée ou de succionner le canal afin de réduire au minimum la formation d'embolies graisseuses. **Conclusions :** Il n'y

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a pas de consensus sur l'échelonnement de l'ATG bilatérale en Ontario. De plus, beaucoup de chirurgiens ne surdimensionnent pas l'orifice d'entrée ou ne succionnent pas le canal fémoral même si des données probantes publiées indiquent que le surdimensionnement peut aider à réduire la formation d'embolies graisseuses. Des recherches plus poussées s'imposent pour comparer le risque de complications de l'ATG bilatérale après une ATG décalée par rapport à l'ATG simultanée.

Over the last 10 years, the rate of total knee replacement has tripled such that it is now the most common joint replacement procedure in Ontario, with a rate approximating 90 per 100 000 people.<sup>1</sup> Many of these patients suffer from arthritis in both knees (Fig. 1), necessitating bilateral total knee arthroplasty (TKA). Almost 19% of all knee replacements in the United States from 1985 to 1990 were bilateral procedures (either staged or simultaneous).<sup>2</sup>

At present, there is a heated debate regarding the timing of bilateral joint replacement surgery. When both knees have failed conservative management and require joint replacement, the question remains: should bilateral TKAs be performed simultaneously, sequentially (under the same anesthetic) or staged (under a separate anesthetic)? It follows that when both knees are affected by end-stage osteoarthritis, replacement of 1 of the 2 joints does not fully restore a patient's function, and the patient remains significantly debilitated. Thus, some advocate simultaneous bilateral knee replacement (involving 1 anesthetic),<sup>3</sup> whereas others rou-

tinely stage the operations from 1 week<sup>4</sup> to 1 year<sup>2</sup> apart.

There are advantages and disadvantages to each approach. Staged bilateral TKA requires 2 hospitalizations and 2 rehabilitation experiences. This places a higher financial burden on the health care system, although each procedure, individually, may place less of a burden on caregivers, physiotherapists and nurses. In contrast, patients receiving simultaneous bilateral TKA return to full function earlier, experience less total anesthetic exposure, and the procedure is more cost-effective.<sup>2,3</sup> Simultaneous bilateral TKAs may be associated with a higher rate of blood transfusion requirements,<sup>5</sup> cardiopulmonary complications and death due to fat embolism when compared with a single knee replacement.<sup>6,7</sup> These potentially higher risks associated with simultaneous bilateral TKA are thought to be the main reason surgeons are reluctant to perform bilateral TKA simultaneously.

Our purpose in this study was to determine the current operative practices of Ontario's orthopedic surgeons performing bilateral TKA. We wanted to determine whether safe

and effective practices are in place and whether these practices contribute to the concerns of orthopedic surgeons with respect to simultaneous TKA.

## Methods

### Sample

A total of 416 orthopedic surgeons were identified from the 1999 *Canadian Medical Directory* and the Canadian Orthopaedic Association membership list and were sent questionnaires. As a tracking mechanism, each survey was numbered. Surgeons who did not respond received only 1 follow-up telephone call.

### Survey

To examine the practice patterns among orthopedic surgeons in performing bilateral TKA, the survey comprised questions related to the timing of these procedures. Surgeons were asked to identify the timing they predominantly use for bilateral TKA from the following options: staged with 2 hospital visits 3, 6 or 12 months apart; staged with 1 hos-



FIG. 1. Standing anteroposterior view of the knees of a 70-year-old man suffering from severe bilateral knee osteoarthritis (left). Follow-up view 1 year after bilateral total knee arthroplasty (right).

pital visit; sequential with 1 anesthetic; simultaneous with 1 team; simultaneous with 2 teams and 1 or 2 set-ups. Data on tourniquet use, extramedullary versus intramedullary alignment guide use, and whether entry holes are over-reamed or suctioned at the time of guide insertion were also gathered. A pilot questionnaire was first sent to a sample of 10 orthopedic surgeons and then modified according to their suggestions.

### Analysis

Statistical analysis was performed using SPSS version 10.0. Frequency distributions were calculated for the responses to each question. To examine the influence on responses of the number of years in practice, surgeons were divided into 2 groups: those who graduated from medical school in 1979 or earlier (earlier graduates) and those who graduated from medical school in 1980 or later (more recent graduates). The cut-off

at 1979 was based on the median year of graduation from medical school of the respondents and that the more recent graduates would represent surgeons in practice for fewer than 20 years. Comparisons of proportions (e.g., 1 v. 2 anesthetics) between the groups were made using  $\chi^2$  tests. Probability values less than 0.05 were considered significant.

### Results

Overall, 219 (53%) of the 416 orthopedic surgeons responded to the questionnaire. Of these, 153 (70%) reported that they currently perform TKA (Table 1). The majority of surgeons perform staged bilateral TKA, with 28%, 37% and 3% of surgeons performing bilateral TKA 3, 6 and 12 months apart, respectively. Only 3% perform staged bilateral TKA during 1 hospital visit. Simultaneous TKA with 2 teams and 2 set-ups was the least performed (2%). Twelve percent of surgeons reported that

they perform simultaneous bilateral TKA with 1 team, and 15% perform sequential bilateral TKA under 1 anesthetic. There were no differences between earlier and more recent graduates with respect to performing staged, sequential or simultaneous bilateral TKA, nor was there any difference in the use of 1 versus 2 anesthetics.

With respect to tourniquet use, all but 10% of procedures were performed with sequential tourniquet use. Only simultaneous bilateral TKA procedures were performed using simultaneous tourniquets. The release of the tourniquet before or after closure was equally distributed among all types of TKA procedures (Table 1).

When performing bilateral TKA, 95% of respondents use an intramedullary femoral alignment guide, 78% use an over-reamed entry hole, and only 53% suction the entry hole. With respect to the tibia, 32% use an intramedullary guide, 60% over-ream the entry hole and 60% suction the entry hole; 22% of surgeons stated that they had never considered over-reaming or suctioning the canal, when performing bilateral TKA.

### Discussion

Simultaneous bilateral TKA does not appear to be common practice among orthopedic surgeons in Ontario (14%). However, by combining sequential and simultaneous bilateral TKA, 29% of bilateral TKAs are being performed under 1 anesthetic in Ontario. Several factors may be responsible for these lower percentages, including the availability of extra support staff (i.e., additional nurses or surgeons) required to perform simultaneous operations, a lack of additional equipment, hesitation because of concern over a perceived higher potential for complications and lack of experience. Further studies are needed to determine the underlying reasons why most orthope-

**Table 1**  
Operative bilateral total knee arthroplasty (TKA) practices of Ontario's orthopedic surgeons

Variable	Bilateral TKA practised: %		
	Staged (2 anesthetics) n = 109	Sequential (1 anesthetic) n = 23	Simultaneous (1 anesthetic) n = 21
<b>Year of graduation</b>			
1979 or earlier	58	48	62
1980 or later	42	52	38
<b>Tourniquet use</b>			
Simultaneous	0	0	71
Sequential	100	100	29
<b>Release of tourniquet</b>			
Before closure	54	57	50
After closure	46	43	50
<b>Alignment system</b>			
<b>Femur</b>			
Extramedullary	2	9	5
Intramedullary	98	91	95
Over-ream	73*	90*	90*
Suction	50	70	55
<b>Tibia</b>			
Extramedullary	68	77	67
Intramedullary	32	23	33
Over-ream	57	60	86
Suction	57	80	71

\*p < 0.05.

dic surgeons in Ontario elect to perform staged bilateral TKA.

Reviewing the current practices of orthopedic surgeons is important to determine whether the safest possible practices are being used. Over-reaming the entry hole before insertion of an intramedullary femoral guide has been shown to decrease the risk of complications due to fat emboli.<sup>8</sup> Canal suctioning may further decrease intramedullary pressure; however, scientific evidence for this assumption is lacking. Among Ontario's orthopedic surgeons, 95% use an intramedullary femoral alignment guide; however, only 78% of these surgeons over-ream the entry hole, and only 53% suction the entry hole; 22% of surgeons had not previously considered over-reaming or suctioning the canal. Thus, many patients may be exposed to a higher risk of fat emboli during their TKA, especially those who are receiving bilateral procedures under 1 anesthetic. We found, however, that a greater number of surgeons performing bilateral TKA under 1 anesthetic are taking the precautionary step to over-ream the femoral canal compared with those performing staged bilateral TKA ( $p < 0.05$ ).

There are limitations to our study. First, members of the Canadian Orthopaedic Association constitute only about 70% of practising orthopedic surgeons in Canada and the 1999 *Canadian Medical Directory* may not capture all Ontario surgeons. Furthermore, we have no way of removing those surgeons who are retired, and would be considered non-clinical, from the sample surveyed. It is also likely that many of the non-respondents do not perform bilateral TKA. Thus, our response rate of only 53% likely represents an under-

estimate. Second, the survey did not determine the reason for the differing practices of bilateral TKA. Third, differentiation between practices in academic and community settings was not determined. There may be systematic reasons for certain practices in each of these settings given the availability of skilled assistants (residents and fellows v. general practitioner assistants) and other resources. Finally, the reason why some orthopedic surgeons do not over-ream or suction the canal was not determined.

The lack of consensus regarding the timing of bilateral knee replacement surgery for patients with severe bilateral knee arthritis in the literature was reflected in our survey responses. The rate of fat embolism after simultaneous bilateral TKA is higher than for a single knee arthroplasty;<sup>6,7</sup> however, most of the cohort studies that have reported an increased risk of complications with simultaneous bilateral total knee replacement compared bilateral knee replacements to unilateral knee replacements. This represents an unfair comparison since any complications associated with the second knee in the unilateral group (operated on at a later date, but not captured in the study) have not been considered.

## Conclusions

Prospective research is required to determine whether the combined risk of complications after staged replacement is less than that for simultaneous replacement. At present, however, since there is some evidence that over-reaming minimizes fat embolization, surgeons should consider implementing this simple technique. In addition, manufactur-

ers should be encouraged to routinely provide reaming equipment that over-reams the canal.

**Competing interests:** None declared.

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