

Cancellation of elective orthopaedic procedures is not a benign practice and is often preventable

Matthew McCall, Mike Peebles, N Amir Sandiford

ABSTRACT

AIM: To quantify the reasons for cancelled elective orthopaedic operations, in particular hip and knee arthroplasty. Secondary aims included defining how long these patients had to wait until their operation, and investigating the impact delayed surgery has on patients in terms of re-presentation to healthcare services.

METHODS: We reviewed hospital records for all cancelled elective orthopaedic operations over a two-year period at a secondary hospital in New Zealand, investigated the reasons for these cancellations, wait times and comorbidities and compared total hip and knee arthroplasty to other elective orthopaedic operations.

RESULTS: 76 orthopaedic elective cases were cancelled. 28 (37%) were hip and knee arthroplasties. 71% of these arthroplasties were cancelled due to hospital related factors (bed availability, operating theatre capacity). Mean wait time for an eventual operation was 56.20 days. Hip joint arthroplasties waited significantly longer (76.10 days, $p=0.008$). 10% of patients awaiting hip and knee arthroplasties re-presented to healthcare services before their eventual operation.

CONCLUSIONS: Patients are having their elective hip and knee arthroplasty operations cancelled for hospital-related reasons that could be avoidable. There are significant wait times contributing to decreased quality of life and may be contributing to avoidable re-presentation with its associated demand on healthcare services.

Osteoarthritis is the commonest form of arthritis. It causes debilitating pain, impairment of function, significant physical disability and consequences to mental health.¹ The disease itself is characterised by loss of articular cartilage, which leads to damaged bone and inflammation. Osteoarthritis affects approximately 50% of people aged over 60 years and almost everyone aged over 80 years.¹

Total joint arthroplasty, in particular hip and knee arthroplasty, are cost-effective procedures that significantly improve patients' mobility, independence and quality of life.² The ageing population has led to an increase in demand for arthroplasty worldwide, and particularly in New Zealand, where the population is ageing and the burden of osteoarthritis is becoming more significant.^{3,4}

Timely access to necessary elective surgery is critical for patients' symptomatic control, functioning, independence and wellbeing. In each region in New Zealand there are strict qualifying criteria before patients can access and undergo these procedures. While awaiting surgery, these patients are at risk of having progression of symptoms and re-presenting to healthcare services with sequelae of their condition: for example, pain, falls or over-use of opioid analgesia.⁵ Cancellation of operations is also distressing for patients and their families and causes significant anxiety and depression.⁶

These cancellations are disruptive and potentially costly for the healthcare system as a result of loss of funding specifically for these procedures as well as inefficiency related to underutilised operating theatres.^{3,7}

Internationally, and particularly in New Zealand, there is a paucity of data examining the impact of cancelled elective orthopaedic procedures.

The aim of this study was to look at the incidence and cause of cancellation of elective orthopaedic procedures, specifically total hip and knee joint replacement, in a regional New Zealand hospital over a two-year period. The secondary aim was to follow these patients' path between cancellation and having their procedure, focusing specifically on re-presentations to healthcare services as a result of their symptomatic osteoarthritis.

We hypothesised that, among orthopaedic cancellations, hip or knee joint arthroplasty would represent a significant proportion of cancellations. We further hypothesised that cancellation of these procedures would mean lengthy delays in eventual surgery and a need for further medical attention between the cancellation and eventual surgery.

Methods

Southland Hospital is a secondary hospital with 157 beds and approximately 1,500 staff offering both acute and elective healthcare. It services a fixed population of 108,000 people, as well as the transient tourism population of Queenstown and the majority of the wider Queenstown-Lakes District. It carries out on average 5,000 operations per year and sees 30,000 presentations through the emergency department annually.^{8,9} On average, 120 primary joint arthroplasties are performed, although there are 300–340 planned primary arthroplasty procedures per year based on scheduling.

A retrospective study of cancelled elective orthopaedic operations at Southland Hospital was performed. Cancelled orthopaedic procedures were identified between June 2017 and July 2019 using hospital records and reports. Inclusion criteria were cases that were scheduled for an elective orthopaedic procedure. We defined "elective" as a procedure that was scheduled in advance (ie, not requiring an immediate operation).

Data were generated from our clinical records department. Records were then cross-referenced with an electronic patient record management system (Health Connect

South) to determine which patients had been scheduled for elective orthopaedic procedures. The following data were recorded for each case:

- Planned operation
- Date of planned operation
- Date of actual operation (and wait time after cancellation)
- Patient age
- Comorbidities and patient's American Society of Anesthesiologists (ASA) score
- Reason for cancellation
- Intervening hospital presentations

The reasons for cancellation were divided into three categories:

1. Patient-related factors:
 - a. Patient presented unfit for surgery, or the patient decided not to proceed with surgery
 - b. Causes related to preoperative optimisation and management, including medication errors or a change in treatment plan
2. Hospital-related factors, such as a lack of post-operative ward or critical care unit (CCU) beds, theatre delays or too many acute cases
3. Other causes

We also analysed the data based on the type of operation:

1. Hip arthroplasties
2. Knee arthroplasties
3. All other elective operations

We compared baseline characteristics of these patients by age, sex, ASA score, reason for cancellation and time to eventual surgery. Data were tabulated using Microsoft Excel (Microsoft, CA, USA).

Statistical analysis

Statistical analysis was performed using GraphPad Prism version 8. Data were tested for normality with the D'Agostino-Pearson omnibus K2 test. The patients were analysed in three separate groups depending on the planned initial operation: hip arthroplasty, knee arthroplasty and other (for all other elective operations). Differences between groups were assessed using unpaired t-tests with Welch's correction. Significance was set at a P-value of 0.05 (GraphPad Prism, CA).

Results

During the study period, 2,397 operations were cancelled in total. Of these, 170 (7%) were orthopaedic procedures, and 76 (45%) were cancelled elective orthopaedic procedures. Of these cancelled elective orthopaedic procedures, 28 (37%) were patients awaiting total hip and knee joint arthroplasty (20 hips and 9 knees) (Table 1). The average age of patients who had cancelled elective hip joint arthroplasty surgery was 70.3 years (47–86; $p=0.005$) and of knee joint arthroplasty patients was 68.0 years (53–84; $p=0.045$).

Hospital-related factors accounted for 57% of all cancelled elective orthopaedic operations. Reasons for cancellations included theatre delays (21%), a shortage of post-operative beds (16%), too many acute patients (who took priority) (12%) and theatre issues, most frequently due to a lack of theatre staff or a lack of equipment (8%) (Table 2). Patient-related factors accounted for 29% of cancellations. These included patients becoming unwell prior to surgery (16%), medication issues (most commonly not stopping anticoagulation prior to procedure) (9%) and a patient's decision to withdraw from the surgery (4%) (Table 2).

In comparison, 71% of cancelled arthroplasties were due to hospital-related factors. Thirty-two percent of cancelled joint arthroplasty operations were due to a lack of beds. Fourteen percent of cases were cancelled due to there being too many acute operations. Twenty-five percent of cancellations were attributable to theatre related factors. Twenty-one percent of cancelled joint

arthroplasties were due to patients being unwell at time of operation (Table 2).

The ASA classification is a preoperative grading system designed as a subjective assessment of a patient's overall health. Classification is based on five classes ranging from ASA-I, describing a completely healthy patient, to ASA-V, describing a moribund patient not expected to live 24 hours without surgery.¹⁰

The mean ASA score for all cancelled elective cases was 2.36. The ASA for knee replacements was 2.67 ($p=0.04$), and for hip cases the ASA was 2.55 ($p=0.005$) (Table 3).

The average wait time from cancellation to time of eventual operation for all elective orthopaedic cancellations was 56.2 days. The average wait time for cancelled elective hip arthroplasty was 76.1 days ($p=0.008$). The average wait time for cancelled knee joint arthroplasty was 26.5 days ($p<0.001$) (Table 4).

Eleven patients (14.5%) whose elective orthopaedic procedures had been cancelled presented to hospital in between cancellation of their procedure and their eventual operation (including to ED, acute orthopaedic outpatient clinic and/or being admitted to hospital). Three (10%) of the cancelled elective hip and knee arthroplasties re-presented to other healthcare services.

Of this group, four presented with problems that were potentially attributable to having delays in their surgery. One patient awaiting hip arthroplasty presented to ED with a fall and hip pain. No patient requiring knee arthroplasty re-presented to healthcare services.

Table 1: Baseline characteristics.

Total number of cancellations (all elective orthopaedic procedures)	76 (100%)
Number of primary elective hip arthroplasties cancelled	19 (26%)
Number of primary elective knee arthroplasties cancelled	9 (12%)
Number of other elective orthopaedic operations cancelled	48 (63%)
Average age (range)	62 (7, 94)
Male/female	55%/45%

Table 2: Reasons for cancelled elective orthopaedic operations.

Reason for cancellation	Number of cancelled elective orthopaedic operations (% of total cancellations)	Number of cancelled joint arthroplasty operations (% of cancellations)
Institutional reasons for cancellation		
Theatre delay	16 (21)	4 (14)
Insufficient beds	12 (16)	9 (32)
Too many acutes	9 (12)	4 (14)
Theatre issue	6 (8)	3 (11)
Total	43 (57)	20 (71)
Patient-related reasons for cancellation		
Patient unfit for surgery	12 (16)	6 (21)
Medication error	7 (9)	0 (0)
Patient decision	3 (4)	0 (0)
Total	22 (29)	6 (21)
Other reasons for cancellations		
Managed non-operatively	7 (9)	0 (0)
Strike	2 (3)	2 (7)
Total	9 (12)	2 (7)
Overall total	76 (100)	28 (100)

Table 3: American Society of Anesthesiologists (ASA) score of cancelled elective orthopaedic operations.

Group	Mean ASA score	p value (vs other orthopaedic elective cancellations)	Age	p value
Hip arthroplasty	2.55	0.07	70.25	0.005*
Knee arthroplasty	2.67	0.04*	68	0.04*
Other orthopaedic electives	2.23		57.62	
All orthopaedic electives	2.36		62.17	

Reasons for presenting to healthcare services included, pain, disability related to the affected joint and concurrent medical illness requiring investigations. In one case, the cause for presenting was unknown due to a lack of documentation.

Discussion

Osteoarthritis is a modern epidemic. It is a cause of significant morbidity, mortality and disability and is incurring substantial costs to patients, healthcare institutions and the wider society.^{11,12} Total joint arthroplasty, in particular hip and knee arthroplasty, have been shown to be clinically effective and cost-effective approaches for the management of hip and knee osteoarthritis. They significantly improve patients' mobility, independence and quality of life.² This benefit is particularly pertinent in New Zealand where the population is ageing and the burden of osteoarthritis is becoming more apparent, with the over-65 age group predicted to make up over 25% of the population in the next 20 years.^{3,4} Kurtz et al have also suggested that patients under the age of 65 will contribute more to the future demand for joint replacement, further emphasising the need for accessibility to timely operations.¹³

In this study, hospital-related factors contributed to 71% of cancelled elective joint replacements and 64% of the total cancelled elective orthopaedic operations. Twenty-five percent of cancelled joint replacements were due to a delay in theatre or a lack of theatre staff or equipment. Caeser et al found that 39% of patients awaiting elective orthopaedic operations

experienced at least one cancellation, with 9% of cancellations being due to "organisational reasons."¹⁴

The prioritising of cases at Southland Hospital was a decision made between specialties who shared operating time in four theatres. There was no formalised process. We were noticing that emergency obstetric and gynaecological operations took priority, followed by emergency general surgery operations, then orthopaedic trauma, elective cancer cases and other electives (including arthroplasty).

The impact of increasing operating theatre capacity on cancellation rates of all elective operations has also been described in the literature. Fayed et al compared cancellation rates of elective procedures before and after the opening of new operating theatres. They observed a statistically significant drop in cancellation rates from 11.1% to 9.0%.⁷ A lack of theatre availability has been reported by other authors investigating cancelled elective procedures, who estimated that cancellation rates ranged from 19% to 65%.^{7,15} However, these studies were conducted in larger hospitals. There is limited data of rates of cancellation, or reasons for cancellation, in regional hospitals where staffing operating theatres could be more difficult due to geographical isolation or less populated centres.

The remaining 28% of hospital-related cancellations in the current study were due to a lack of post-operative ward beds or too many acute operations taking priority over elective operations. Cancelled elective joint arthroplasties were more likely to be due to a lack of post-operative beds (26%).

Table 4: Mean time (in days) from cancellation to eventual operation.

Group	Mean Wait time (days)	p value (vs other orthopaedic elective cancellations)
Hip arthroplasty	76.1	0.008*
Knee arthroplasty	26.5	<0.001*
Other orthopaedic electives	51.75	
All orthopaedic electives	56.2	

There were also avoidable cancellations due to patient-related factors, including errors in starting or stopping medications (8%), the most common being not stopping anticoagulation. Sixteen percent of cancellations were due to the patient being assessed as unfit for surgery. As the hospital is in a rural city, a significant number of patients had occupations including farming and industrial work and would present with cuts and superficial skin infections that we deemed largely unavoidable and an important factor to consider when analysing cancellation rates. However, to our knowledge, the impact of these cancellations on patients has not been reported.

The results of this study suggest that 9.35% of people awaiting total hip or knee joint arthroplasty experienced at least one cancellation. Patients awaiting hip joint arthroplasty waited a significant 19.9 days longer than the average wait for elective orthopaedic procedures ($p=0.008$). The mean ASA score of patients who had cancelled hip arthroplasty was 2.55, and the mean ASA score of patients who had cancelled knee arthroplasty was 2.67. According to the New Zealand Joint Registry, the mean ASA score of patients who had elective hip arthroplasties nationally was 2.1, and the mean ASA score for patients who had elective knee arthroplasties was 2.15.⁵ This shows that the patients who are having their elective joint replacements cancelled are on the whole a more comorbid population when compared to the national average, yet they are waiting longer for their eventual operation. The exact reason for this is unclear. It is unlikely that this is simply due to a lack of perioperative optimisation, as patients in this hospital were not listed for an operation until they were optimised as assessed by a clinical nurse specialist and an anaesthetist. It may be that in the study period there were more hip arthroplasties than knees on the waiting list, which would put hip arthroplasties at a higher risk of cancellation.

It seems logical that these patients are more likely to require medical attention and intervention and that they could deteriorate, leading to lack of mobility, deconditioning and/or falls. To the best of our knowledge, there is no formalised system of measuring the impact that cancelled arthroplasty is having on patients. Data collection from

hospital and primary care follow-up of these patients would be beneficial to fast-track these patients onto new operating lists in an attempt to reduce significant waiting times.

Improving cancellation rates

Although it is beyond the scope of this study to establish a strategy that would improve rates of cancellation, there are certainly points for consideration that could potentially result in reduced rates of cancellation. Measuring data on operating theatre efficiency may also help improve cancellation rates, and this has been described in the literature. For example, Pandit et al have measured efficiency and “production potential” in the operating theatre by quantifying a number of variables among surgical specialties including speed of operating, the number of lists over or under-running, time spent in between cases, the quality of operating and rates of complications.¹⁶ Although the study suggested shortfalls in one area may be made up for with good performance in others, cancellations had a significant impact and would be reason enough for this to be addressed. This study also failed to address the impact that cancellations had on patients.¹⁶

Addressing patients’ preoperative optimisation, including compliance to perioperative medication changes, may be another way to improve the rates of cancellation. The hospital in the current study does have a pre-assessment process led by nurse specialists and anaesthetists. Although not a major contributor to cancellations in the current study, the literature describes this as a recognised issue with a number of strategies similar to the aforementioned being implemented in many hospitals worldwide. Vetter et al also suggested pictorial or colourful medication charts as well as written charts helped with compliance, and that elderly patients with more comorbidities require a more concerted effort when it comes to medication compliance.¹⁷

Nursing resource teams are another way Southland Hospital have tried to improve efficiency in the operating theatre. These teams were designed to have consistent personnel to enhance continuity and theoretically enhance performance. There were no data available to indicate the efficacy of this strategy. However, this may be a way to improve efficiency and throughput during

individual lists and thus reduce the rates of cancellation.

The joint reconstruction team at Southland Hospital has standardised implants and inventory related to hip and knee arthroplasty in order to reduce the rates of equipment error and inefficiencies related to this aspect of care delivery and operative output.

Limitations

This study was limited by the relatively small study size. However, we followed the population over a longer period to capture variation and minimise temporal bias. We cannot draw definitive conclusions about the causative relationship between cancelled orthopaedic procedures and patient complications, given the lack of temporality in the study, but it gives us reason to suspect that some patients awaiting operations after cancellation are suffering adverse events as a result of delay.

The data collected are from hospital theatre records and accuracy relies on the input of data from surgical teams and theatre staff. To the best of our knowledge, all cancelled cases were included in the dataset, but we cannot say with absolute certainty that all cancellations were recorded over the two-year period.

Access to general practitioner records would have been beneficial to get an accurate gauge of the impact of cancelled

operations on patients (eg, use of opioid analgesia or falls that did not require a hospital presentation).

External validity may be limited given the study was conducted in a secondary hospital. Multi-centre studies and comparison with larger centres would be beneficial.

Conclusion

Cancelled elective orthopaedic operations, in particular hip and knee arthroplasty, are not an infrequent occurrence. Cancellations affect patients' quality of life and national district health boards. These patients are experiencing significant delays in eventual surgery. Fifty percent of these cancellations are due to hospital and theatre issues that are often preventable. Resources should be directed towards improving the systems in place to reduce the rate of cancellations. These patients have significant comorbidities and are at risk of further medical complications before rescheduled surgery. We found limited evidence supporting our hypothesis that delayed operations are leading to more frequent re-presentations to healthcare services with sequelae of worsening osteoarthritis. However, given the small study size and limited access to information from primary care facilities, this is an area where further research would be valuable.

Competing interests:

Nil.

Author information:

Matthew McCall: House Officer, Christchurch Hospital, Canterbury District Health Board, Christchurch, New Zealand.

Mike Peebles: Registrar, Obstetrics and Gynaecology, Hutt Hospital, Hutt Valley District Health Board, Lower Hutt, New Zealand.

Nemandra Amir Sandiford: Orthopaedic Surgeon, Senior Lecturer, University of Otago, Southland Hospital, Southern District Health Board, Invercargill, New Zealand.

Corresponding author:

Matthew McCall, Christchurch Public Hospital,
2 Riccarton Avenue, Christchurch 8011, 027 771 5595
matthew.mccall2@cdhb.health.nz

URL:

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