

Total joint replacement: implication of cancelled operations for hospital costs and waiting list management

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Abstract

Objective — To identify aspects of provision of total joint replacements which could be improved.

Design — 10 month prospective study of hospital admissions and hospital costs for patients whose total joint replacement was cancelled.

Setting — Information and Waiting List Unit, Musgrave Park Regional Orthopaedic Service, Belfast.

Patients — 284 consecutive patients called for admission for total joint replacement.

Main measures — Costs of cancellation of operation after admission in terms of hotel and opportunity costs.

Results — 28(10%) planned operations were cancelled, 27 of which were avoidable cancellations. Five replacement patients were substituted on the theatre list, leaving 22(8%) of 232 operating theatre opportunities unused. Patients seen at assessment clinics within two months before admission had a significantly higher operation rate than those admitted from a routine waiting list (224/232(97%) *v* 32/52(62%), $\chi^2 = 58.6$, *df* = 1; *p* < 0.005). Mean duration of hospital stay in 28 patients with cancelled operations was 1.92 days. Operating theatre opportunity costs were 73% of the total costs of cancelled total joint replacements.

Conclusion — Patients on long waiting lists for surgery should be reassessed before admission to avoid wasting theatre opportunities, whose cost is the largest component of the total costs of cancelled operations.

Introduction

There is an increasing awareness in orthopaedics of the cost, quality, and outcome of the treatment offered.¹⁻⁴ The number of total joint replacements being performed, particularly knee replacements,⁵ and the number of patients being added to waiting lists is steadily increasing. Total joint replacement has a low cost per quality adjusted life year,⁶ but each total hip replacement costs about £2500 and each total knee replacement £3500 (1989-90 costs). Limited resources are available for total joint replacements, and these resources must be used efficiently.

We determined the number of planned total

joint replacements in our unit that were cancelled and the rate of utilisation of theatre opportunities in order to calculate the cost of the operations.

Patients and methods

Between July 1990 and May 1991, 284 patients were called for admission for total hip (246) or total knee (38) replacement by the information and waiting list unit. The clinical component of this unit consists of a consultant and senior registrar whose primary task is to control the waiting list for hip replacement. Two hundred and thirty two patients (group A) had been seen at an outpatient clinic within two months of their admission date. Eleven of these were seen at preoperative assessment clinics similar to those used during our hip waiting list initiative,⁷ and 221 were seen at extra orthopaedic clinics which formed part of a "blitz" on the outpatient waiting list. The remaining 52 patients (group B) were admitted from routine waiting lists and had not been seen by the orthopaedic service for six to 38 months.

CANCELLATION OF OPERATIONS

Cancellation of surgery was defined as the deferral of surgery and discharge of the patient from hospital. Surgery was cancelled on finding absolute or relative contraindications to arthroplasty on clinical assessment or laboratory tests — for example, full blood count or microbiological testing of urine.⁸ Cancellation was considered to be unavoidable or avoidable: unavoidable cancellation was defined as any cancellation whose reasons could not have been detected before admission, and all other cancellations were regarded as avoidable.

As patients were called, admitted, and discharged the following information was entered weekly on to an IBM compatible personal computer with Lotus 123: (a) number of patients admitted, (b) number operated on, (c) number discharged without operation, (d) reasons for cancellation of operation, (e) duration of stay of patients whose operation was cancelled, and (f) number of patients with cancellations whose place on the operating list was taken by another patient. At the end of the study period the patients' notes and secretarial and operating theatre records were examined to ensure that the information was accurate.

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Accepted for publication 9 December 1991.

Table 1 Number (percentage) of patients operated on or with cancelled operations after admission for total joint replacement

Patient group	Operation		Total admitted for operation
	Received	Cancelled	
Group A (preoperative assessment or blitz clinic)	224(97)	8(4)	232
Group B (routine waiting list)	32(62)	20(39)	52
Total	256(90)	28(10)	284

COSTS

The cost to the health service of the cancelled operations was calculated on the basis of the 1989–90 specialty cost statement for orthopaedic services at this hospital. Inflation was taken into account by adding 8% to the 1989–90 costs.

Hotel cost is the daily cost of a hospital bed – that is, the average total cost in providing a hospital bed and its associated medical and other staff, laboratory tests, and routine radiography. This daily cost was £108.

Opportunity cost – The cost of an operating theatre session was £1413.90 and is referred to as the opportunity cost. This cost was reached by dividing the total annual costs for the theatres (£1 875 650 (excluding implants)) by the number of available operating sessions a year. A routine primary total hip or knee replacement requires half a theatre session or about 90 minutes' theatre time and has an opportunity cost of £706.95.

The costs as we calculated them included fixed and variable elements.

Statistical analysis was by a χ^2 test with one sided significance level.

Results

All patients attended for admission. The age range of patients in group A was 37–88 (mean age 68, median age 68); 131 patients were female and 101 male. The age range of those in group B was 46–87 (mean age 65, median age 70); 29 patients were female and 23 male. Twenty eight (10%) of the 284 planned operations were cancelled (one knee replacement and 27 hip replacements). The age range of the patients whose operation was cancelled was 50–81 (mean age 65, median age 69); 15 were male and 13 female. Twenty patients from group A and eight from group B had their operations cancelled (table 1), and the difference in operation rates was significant (group A, 224/232(97%) *v* group B, 32/52(62%), $\chi^2 = 58.6$, *df* = 1; *p* < 0.005). Twenty three (8%) patients had their operation cancelled after clinical assessment, one of which was an unavoidable cancellation in a patient with severe chest pain on the morning of surgery. Five (2%) patients had an avoidable cancellation on the basis of

Table 2 Duration of hospital stay in patients with cancelled operations

Patient group	Range of stay (days)	Mean stay (days)
Group A (n = 8)	1–5	2.5
Group B (n = 20)	1–6	1.7
Total (n = 28)	1–6	1.9

Table 3 Operating theatre opportunities

Patient group	Opportunities		
	Available	Used	Unused(%)
Group A	232	227	5(2)
Group B	51	34	17(33)
Total	283	261	22(8)

laboratory results; three had asymptomatic bacteriuria and two had abnormal blood counts. Thus 27(96%) of the 28 cancellations were avoidable.

Twenty two avoidable cancellations were caused by problems discovered either during discussion with the patient or on physical examination. Three patients declined operation: two were unwilling to accept the risks involved (both were assessed as American Society of Anesthesiologists (ASA) grade 3) and the third refused the possibility of a blood transfusion on religious grounds and, after discussion with the surgeon, declined the operation. One woman receiving hormone replacement therapy had her operation cancelled. Other clinical reasons for cancellation were cardiovascular problems (five patients); dental caries (five); respiratory problems, skin lesions, and failure to satisfy indications for surgery (three each); and diabetes, obesity, existing treatments, and senile dementia (one each). In four patients there was more than one reason for cancellation. Hypertension accounted for cancellation in three of the five patients with cardiovascular problems and severe cardiac failure in the two others.

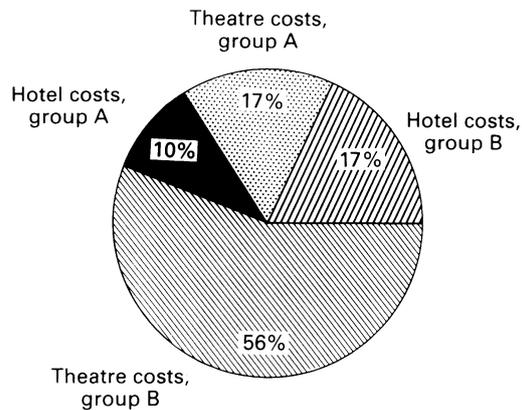
The patients whose operation was cancelled spent from one to six days (mean 1.9 days) in hospital (table 2), and the patient whose cancellation was unavoidable stayed in hospital for three days. Four patients were discharged on the day of admission.

Two hundred and eighty three theatre opportunities were allocated to the 284 patients admitted. One patient whose operation was cancelled was replaced by another whose operation was also cancelled, resulting in 283 rather than 284 theatre opportunities. Five (18%) patients with a cancellation were replaced on the operating list by another patient. Twenty two (8%) theatre opportunities were unused owing to no suitable replacement being available. Seventeen (33%) of the 51 theatre opportunities allocated to group B and five (2%) of the 232 opportunities allocated to group A were unused (table 3).

The total cost to the health service of the 28 cancelled operations was £21 384.90; £5694.75 (27%) was incurred by group A and £15 690.15 (73%) by group B (table 4 and figure). Theatre opportunity costs for the cancelled operations were £15 552.90 (73%);

Table 4 Hotel, theatre opportunity, and total costs (£) for cancelled operations

Patient group	Cost		
	Hotel	Theatre	Total
Group A (n=8)	2160.00	3534.75	5694.75
Group B (n=20)	3672.00	12018.15	15690.15
Total (n=28)	5832.00	15552.90	21384.90



Total costs for 28 cancelled total joint replacements = £21 384

Hotel and theatre costs for eight patients in group A and 20 patients in group B with cancelled total joint replacement operations

£3534.75 was incurred for group A and £12 018.15 for group B. Hotel costs were £5832 (27%): £2160 and £3672 for groups A and B respectively. The average cost per cancelled operation was £711.84 for a patient in group A and £784.50 for a patient in group B.

Discussion

About 10% of planned total joint replacements were cancelled. Most of these cancellations were avoidable. The conditions responsible for cancelled operations should be readily recognisable at routine or preoperative assessment clinics. There was a significant difference in operation rates for groups A and B. This confirms that patients on a long waiting list should be reassessed before admission for major surgery. Alternatively, we should follow the advice of the Royal College of Surgeons of England that "surgery should only be offered to patients who are clinically ready for it and if there is a real expectation of performing the operation within a reasonable time".⁹

Operating theatre opportunity costs accounted for 73% of the total cost of our cancelled total joint replacements, and an operating theatre opportunity costs almost seven times as much as a day in hospital. We should, therefore, ensure that all available theatre sessions are fully used. The average costs per cancellation were greater for patients in group B than in group A because fewer suitable patients were found to replace those in group B with cancelled operations, resulting in a greater proportion of unused theatre opportunities. There is an apparent discrepancy between the total number of operations performed (256) and the total number of theatre opportunities used (261). This is because theatre opportunities were used by the five substitute patients. These patients were not, however, part of the original cohort of patients who formed the subject of this study. The management intention for the four patients discharged on the day of admission was that they were admitted for

inpatient surgery. Consequently, they may not be regarded as day cases, and the daily inpatient cost was applied to them. An intermediate figure may be a more accurate reflection of the true cost. The total hotel costs for these patients were £432 (£108 × 4) and this was the amount used in calculating total hotel costs.

The length of hospital stay for several patients whose operation was cancelled may seem to be excessive but had sound medical or logistical reasons. Some patients were in such poor health on admission for surgery that they had to stay in hospital for medical treatment. Patients were not discharged until it was obvious that despite medical treatment they would not be fit for surgery during that admission. A decision regarding a patient's suitability for total joint replacement is usually made by senior surgical or anaesthetic staff, or both, who are commonly free to see patients only in the evenings or at weekends. This may influence the duration of hospitalisation of patients with cancelled operations and the admission of substitute patients. Arranging admission of substitute patients outside normal office hours is difficult, and patients waiting for total joint replacement are commonly elderly and unable to come into hospital at short notice. Reassessment of patients on long waiting lists before admission for surgery could reduce the rate of cancellation of total joint replacements and the associated costs. A pool of fit patients willing to come into hospital at short notice could be used as a source of replacements for any cancellations that might arise. This pool would require constant updating. We found only six patients to replace those with our cancelled operations, one of whom proved to be unfit for surgery. Costs would be incurred in performing regular preoperative assessment clinics, but they should be less than those of cancelling surgery. This is a subject worthy of further investigation. The cost incurred owing to cancellation of surgery is small in the context of a hospital's annual costs. It is true that consumables are "saved", and that this represents a "saving" to the hospital; these items are available for future use should they be required. Hotel and theatre opportunity costs have been irretrievably incurred and it is not legitimate to subtract these spurious "savings" from them in calculating the cost of cancelled total joint replacements.

Our failure to use almost 8% of theatre opportunities allocated to total joint replacement is an indictment of our present method of managing surgical waiting lists and would surely be a disturbing revelation to patients on waiting lists. Although our patients may not be representative of all patients because of their preselection by the waiting list unit, our findings should be relevant to surgical waiting lists in general. We need to examine critically our surgical working practices. By not assessing patients in preoperative assessment clinics we waste money, deprive patients of operations, and lengthen waiting lists. This is an aspect of

practice in which surgeons can contribute to reducing waiting lists.

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