THE INCIDENCE OF FATAL PULMONARY EMBOLISM AFTER KNEE REPLACEMENT WITH NO PROPHYLACTIC ANTICOAGULATION

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We made a prospective study of the incidence of fatal pulmonary embolism in patients after total knee replacement with no prophylactic anticoagulation. There were 499 consecutive patients having 527 knee replacements. They all wore anti-thromboembolic stockings and were mobilised 48 hours after surgery.

No patient was lost to follow-up. One patient died of pulmonary embolism 22 days after operation. There were no other deaths within three months of operation. The incidence of fatal pulmonary embolism was 0.19% (95% confidence interval: 0 to 0.6%).

Fatal pulmonary embolism is rare after total knee replacement without prophylactic anticoagulation and the routine anticoagulation of these patients is of doubtful value.

*J Bone Joint Surg [Br] 1993; 75-B:940-1.
Received 20 April 1993; Accepted 2 June 1993*

Fatal pulmonary embolism is a catastrophic complication of major orthopaedic surgery. The incidence after total hip replacement has been reported to be from 1.7% to 2.3% (Johnson, Green and Charnley 1977; Salzman and Davies 1980) and may be reduced by using prophylactic anticoagulation (Collins et al 1988; THRIFT 1992). The case, however, for routine prophylactic anticoagulation in total knee replacement surgery is less certain.

The value of thromboprophylaxis in total knee replacement can only be assessed in relation to the natural history of the complication, in a group receiving no prophylaxis. We have performed a prospective study of the incidence of fatal pulmonary embolism in a series of patients having total knee replacements with no prophylactic anticoagulation.

PATIENTS AND METHODS

All patients who had a total knee replacement under the care of one of two consultants (IMP and SRS), were prospectively entered into an outcome study, using a database of Clinical Accountability, Servicing, Planning and Evaluation (CASPE) which holds information on the clinical status of patients before surgery, and at three and 12 months after surgery. This database was used to identify patients who survived more than three months. We considered that all fatalities from postoperative pulmonary embolism would have occurred within this period of time (Carson et al 1992; Huber et al 1992).

Prophylactic anticoagulation was provided only for patients with a history of previous thromboembolism: such patients were excluded from the study. We did not exclude patients taking regular non-steroidal anti-inflammatory drugs since there is no proof that they have antithrombotic action.

Graduated compression stockings were used routinely for all patients, and after operation the patients rested, with the knee immobilised, for 48 hours. Active mobilisation then started with physiotherapy and weight-bearing; continuous passive motion was not used. Patients left hospital when they could straight-leg raise and achieve 100° active flexion.

Patients who did not have complete follow-up data were identified and investigated by telephone interviews with general practitioners and the patients themselves, with the aim of establishing survival. The 95% confidence limit for the incidence of fatal pulmonary embolism was estimated by using binomial probability to calculate the standard error.

RESULTS

A total of 523 patients had 615 total knee replacements from 17 April 1989 to 31 July 1992. We considered one-stage bilateral knee replacements ($n = 32$) and staged bilateral procedures within three months ($n = 22$) as single episodes.

A total of 24 patients had prophylactic anticoagulation because of increased risk factors: there were no cases of pulmonary embolism in this group and they were

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0301-620X/93/6683 \$2.00

Table I. Previous reports of the incidence of fatal pulmonary embolism after total knee replacement without anticoagulant thromboprophylaxis

Author	Number*	Fatal pulmonary embolism	Incidence (per cent)
Stulberg et al (1984)	49	0	0.0
Stringer et al (1989)	55	0	0.0
Kim (1990)	244	0	0.0
Mohr et al (1992)	152	1	0.7
Khaw et al (1993)	537	1	0.2

* subgroups which did not receive anticoagulants

excluded from the study. These exclusions left 499 patients who had 527 total knee replacements. Their average age was 65 years (16 to 89); 314 were female and 185 were male; 319 had osteoarthritis (60%) and 180 had rheumatoid arthritis (34%).

No patient was lost to follow-up and only one died within three months of surgery. This patient had had a one-stage bilateral knee replacement and had suffered myocardial infarction on the first postoperative day. She later developed a symptomatic pulmonary embolism and died 22 days after surgery. Thus the incidence of fatal pulmonary embolism was 0.19% (95% confidence limits: 0 to 0.6%). Seven other patients (1.3%) developed clinical symptoms and signs of pulmonary embolism in hospital; the diagnosis was confirmed in all cases by isotope ventilation-perfusion scanning. All seven recovered after treatment by anticoagulation.

DISCUSSION

Our study has shown a low incidence (0.19%) of fatal pulmonary embolism after total knee replacement without prophylactic anticoagulation. Non-fatal pulmonary embolism was diagnosed in another 1.3% of patients, but the incidence of silent pulmonary embolism is unknown. Other reports listed in Table I have also suggested that there is a low incidence (0 to 0.65%) of fatal pulmonary embolism after knee replacement surgery without prophylaxis. Our investigation has confirmed these findings and provides 95% confidence levels to show an incidence of fatal pulmonary embolism of less than 0.6%.

Postoperative pulmonary embolism is thought to result from thrombus dislodged from deep veins in the legs. The incidence of deep-vein thrombosis in knee replacement surgery is known to be high (57% to 84%; Stulberg et al 1984), but most thromboses are in the calf and are less likely to embolise than more proximal iliofemoral thrombi (Mavor and Galloway 1969; Rosenow, Osmundson and Brown 1981). This may help to explain the low incidence of clinical pulmonary embolism.

The incidence of fatal pulmonary embolism in our series is considerably lower than that reported for hip

surgery. Others have considered that hip and knee replacement have the same risk for pulmonary embolism and therefore the same needs for thromboprophylaxis (Lowe et al 1992). This assumption was not based on a study of pulmonary embolism after knee arthroplasty, and the role of prophylaxis must now be considered in relation to the low mortality that we have demonstrated. The evaluation of prophylactic regimes will be difficult. Proof of a significant reduction in mortality, say from 0.2% to 0.1%, would require a prospective, randomised, double-blind trial of tens of thousands of cases (Yusuf, Collins and Peto 1984). Even meta-analysis of composite data from many centres is unlikely to give an answer.

Conclusions. The incidence of fatal pulmonary embolism after total knee replacement without anticoagulation was only 0.19%. Thus a very large cohort of patients would be required to demonstrate a reduction in this incidence. Our results suggest that it would be ethical for future studies to use control groups without anticoagulant prophylaxis.

The authors would like to thank Mrs J. Goodfellow, research co-ordinator for the CASPE database, for her invaluable help, and Mrs T. Brown for typing the manuscript.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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