

Cement as a risk factor for deep-vein thrombosis

COMPARISON OF CEMENTED TKR, UNCEMENTED TKR AND CEMENTED THR

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A total of 110 total knee replacements (TKRs) was randomised to receive either a cemented or an uncemented prosthesis. Postoperative venography at five to seven days was used to compare the prevalence, site and size of deep-vein thrombosis (DVT). We also compared the findings with those of postoperative venography in a group of patients with cemented total hip replacements (THRs).

The total prevalence of DVT was significantly greater after uncemented (81%) than after cemented TKR (55%). Both knee groups had a significantly higher prevalence of DVT than in cemented hip replacements (32%). We found no difference in the proportion with proximal DVT in the three groups (14%, 15% and 16%). The median length of the thrombi was significantly greater after cemented (26.5 cm) than after uncemented TKR (11 cm) or after cemented THR (7 cm). This difference was mainly due to greater lengths of distal rather than proximal thrombi.

We conclude that the use of cement may affect the formation of DVT after joint replacement, but does not appear to lead to an increased incidence.

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The incidence of deep-vein thrombosis (DVT) after total knee or hip replacement (TKR, THR) is reported to be up to 70% without prophylaxis.¹⁻⁷ Most of these series were of cemented prostheses; it is possible therefore that cement may have thrombogenic properties and so influence the

incidence of DVT. Reports concerning this are conflicting; activation of the clotting cascade and concurrent fibrinolysis have been described during and after TKR and THR,^{8,9} but it is uncertain whether this activation is different in cemented compared with uncemented prostheses.^{10,11} Clotting investigations during operation have indicated that, at least for THR, both reaming of the medullary canal and cementing of the femoral stem can enhance coagulation, but that preparation and cementing of the acetabulum do not.^{10,11} Some earlier clinical reports have suggested that cemented THR has an increased risk for DVT over uncemented THR,^{9,12-14} but a more recent prospective, randomised trial has indicated that this may not be the case.¹⁵ There are fewer reports on TKR, but prospective studies suggest that cementing does not increase the postoperative incidence of DVT,^{16,17} at least in Asian patients who are thought to have a lower risk of thrombosis.

The potential thrombogenicity of cement may influence not only the incidence, but also the size and position of thrombi, but no previous studies have examined the effect of cement on these factors. These could be important, since more extensive DVT may increase the risk of fatal pulmonary embolism and of the postphlebotic syndrome. For the last four years, the senior authors (PJG, WMH) have performed TKR and THR without any mechanical or chemical DVT prophylaxis, but all patients were routinely screened for DVT by unilateral venography after operation. In addition, we have conducted a prospective, randomised trial on the outcome of cemented *versus* uncemented TKR. This unique situation has allowed us to review the venograms of all patients with TKRs and to compare those after cemented or uncemented replacements. We have also reviewed the venograms of patients after THR, in which a cemented prosthesis had been used routinely.

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Patients and Methods

Since 1993, the senior authors (PJG, WMH) have not used stockings, pneumatic compression boots, NSAIDs, warfarin, heparin in any form, dextran, or ergot alkaloids in joint replacements. Patients were routinely mobilised within 48 hours of surgery and screened for DVT by unilateral venography at five to seven days.

All patients having primary, unilateral TKR or THR

during the study period were registered on a database, and all case notes were examined. There were 61 cemented TKRs, 56 uncemented TKRs and 111 cemented THRs. The only 17 patients excluded from the study were those having anticoagulation in the perioperative period because of a history of pulmonary embolism, recurrent DVT or for medical reasons. These were three in the cemented TKR group, four in the uncemented TKR group and ten in the cemented THR group.

Operations. All operations were elective after selection in outpatient clinics, and performed or supervised by one of two experienced surgeons (PJG, WMH). For TKR, a PFC prosthesis (Johnson & Johnson, Bracknell, UK) was inserted under tourniquet control using a medial parapatellar approach. Randomisation for a cemented or uncemented prosthesis was at operation using random number sheets. THR used a Hardinge approach and a cemented Charnley prosthesis.

Venography. Venography at day 5, 6 or 7 after operation was unilateral by the method described by Rabinov and Paulin,¹⁸ except that the superficial veins were occluded by an ankle tourniquet. For the purpose of this study, the venograms were reviewed by a radiologist blinded to the original clinical report. DVT was classified as proximal (popliteal, femoral, iliac) or as distal (peroneal, posterior tibial, anterior tibial) when no proximal thrombosis was detected. Record was made of the amount of thrombus on the venogram, measured in centimetres, its position and its continuity.

Statistical analysis. We used chi-squared analysis of differences in proportions for the prevalence of DVT after THR and TKR, with the Mann-Whitney U test and Student's *t*-test for numerical non-categorical data.

Results

DVT prevalence. As shown in Figure 1, after cemented TKR, 32 of 58 venograms (55%) showed evidence of DVT (14% proximal and 41% distal). This was significantly less ($p=0.004$) than after uncemented insertion of a knee replacement in which 42 of 52 venograms (81%) demonstrated DVT (16% proximal and 65% distal) but significantly greater ($p=0.004$) than after a cemented hip replacement in which 32 of 101 venograms (32%) showed evidence of DVT (16% proximal and 16% distal). The difference between uncemented knees and cemented hips was highly significant ($p<0.0001$). There were no statistical differences in the proportions of proximal DVTs.

DVT size. As shown in Figure 2, after cemented TKR, the median length of the thrombus was 26.5 cm (mean 28.1, range 7 to 59; *SD* 14.9). This was very significantly greater ($p<0.0001$ for both) than after uncemented TKR with a median of 11 cm (mean 14.7, range 2 to 41; *SD* 11.4) or cemented THR with a median of 7 cm (mean 9.3, 0.5 to 33; *SD* 8.0). In uncemented TKR there were significantly larger thrombi than in cemented THR ($p=0.032$). The larger size

of the thrombus was generally attributable to distal DVT ($p<0.0001$). For proximal thrombi there were no significant differences in their lengths between the three groups.

Proximal DVT characteristics. Figure 3 shows proximal DVT as being isolated from or continuous with distal DVT. After TKR (cemented and uncemented), six of 16 proximal DVTs were in isolation and ten were continuous with distal

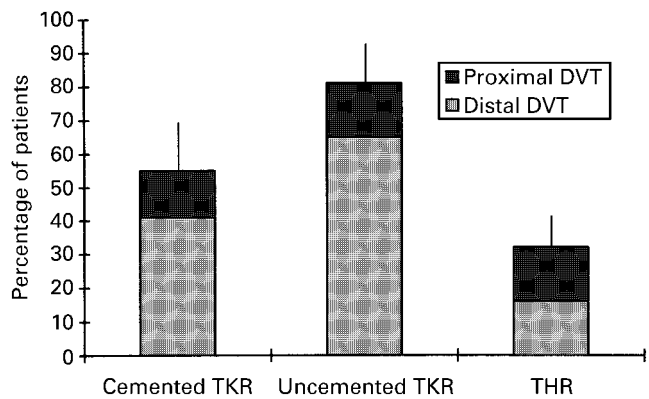


Fig. 1

The percentage of patients with postoperative DVT diagnosed on venography at five to seven days after surgery.

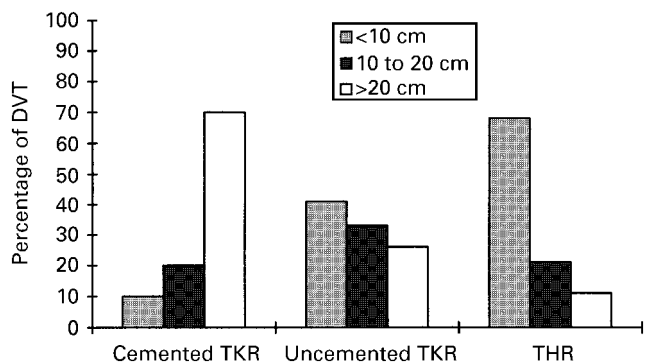


Fig. 2

Length of thrombus grouped into sizes of less than 10 cm, 10 to 20 cm or greater than 20 cm.

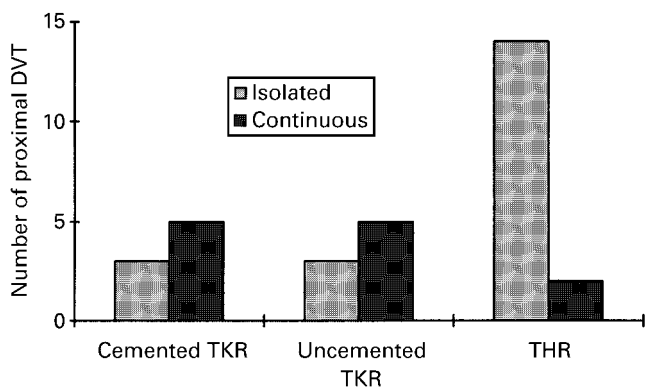


Fig. 3

Numbers of proximal DVTs. Light-grey shows isolated proximal DVTs and dark grey those with massive proximal extension of distal DVT.

DVT. After cemented THR 14 of 16 were isolated and two were continuous.

Discussion

Our study has shown that postoperative DVT was more common in patients with uncemented than in those with cemented TKRs, in a prospectively randomised trial and with considerable statistical significance ($p = 0.004$). This is surprising, but the main relevance is the demonstration that cementing did not increase the prevalence of DVT. Previous work on the prevalence of DVT after cemented or uncemented replacements has been contradictory, showing either an increase with cement^{12-14,19} or no differences.¹⁵⁻¹⁷

In the only previous prospective study on TKR in 244 patients of Asian origin,^{16,17} cemented and uncemented prostheses showed a similar postoperative prevalence of DVT (25% and 23.8%). No patient had prophylaxis, but the prevalence of DVT was much lower than in our study. The many reasons for this discrepancy include interobserver error, the criteria for diagnosis, and possibly the lower rate of DVT thought to occur in patients of Asian origin. The largest prospective trial of THR reported the postoperative prevalence of DVT after cemented and uncemented prostheses in 250 randomised patients.¹⁵ There were no significant differences between the venographic prevalence of DVT at six days after surgery in the two types of prosthesis.

We also studied the amount and the position of DVTs. There are no direct comparisons for this part of our study. We found that DVT was less common after cemented TKR, but that the amount of thrombus, when it was detected, was significantly greater than after either uncemented TKR or cemented THR. The high median length of 26.5 cm, with some up to 59 cm, was surprising in comparison with the low values for uncemented TKR (11 cm) and cemented THR (7 cm). The smaller lengths of DVT after a cemented THR warrant comment. The hip patients were not randomised, and there are no uncemented THRs for comparison, but it is interesting that the median length is so low if cement is thought to act systemically rather than locally. In addition, we found no evidence for any local thrombogenic effect after cemented TKR. The prevalence of DVT in the veins around the knee was similar to that after uncemented TKR.

The larger thrombi could theoretically increase the risk of fatal pulmonary embolus or of postphlebotic syndrome, but as yet there are no conclusive data to support this. The proximal propagation of distal DVT is recognised, but the relationship between size and ability to propagate is not clear. We could find only one orthopaedic study which

addressed this: in a small series, only distal thrombi longer than 9 cm were found to propagate proximally.²⁰

We conclude that the use of cement does not increase the incidence of DVT after TKR, but that it does appear to increase the amount of thrombus which is formed.

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