Thromboprophylaxis in hip arthroplasty

Dextran with graded compression or preoperative dextran compared in 150 patients

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Totally, 150 patients, subjected to total hip arthroplasty, were randomly allocated into three prophylactic groups with either conventional dextran alone or with additional graded compression stockings or with additional preoperative administration of dextran. The overall frequency of deep venous thrombosis (DVT), as studied by radioactive fibrinogen uptake test and ascending phlebography of the operated on thigh was in the conventional dextran group 46 percent, the additional stockinged group 30 percent, and in the additional preoperative dextran group 52 percent. In the stockinged group, there was a lower frequency of DVT in the nonoperated on leg as well as, on an average, about 350 mL less peroperative bleeding as compared with the other two groups. No adverse reaction occurred from dextran administration.

Increased and prolonged postoperative administration of dextran decrease the number of femoral DVTs.

Dextran infusion reduces fatal pulmonary embolism (Bergentz 1978), as well as femoral vein thrombosis (Fredin et al. 1984). However, the frequency of DVT in the operated on extremity after a total hip arthroplasty is about 20 percent despite dextran 70 prophylaxis (Fredin et al. 1984), and thus a further reduction is desirable. Preoperative dextran infusion could theoretically enhance the thromboprophylactic effect (Åberg et al. 1975). Another possible way of improving the prophylactic effect would be to combine different methods. Dextran together with graded elastic compression has been demonstrated additively effective in abdominal surgery (Bergqvist and Lindblad 1984).

The aim of the present study was to establish whether graded compression stockings and preoperative administration of dextran 70 could enhance the thromboprophylactic effect of conventional peroperative and postoperative administration of dextran 70 in elective hip surgery.

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Patients and methods

Patient groups

Prior to total hip arthroplasty, 150 patients were randomly allocated into three prophylactic groups. The operation was performed by a lateral approach in the supine position with trochanteric osteotomy and epidural anesthesia. Totally, 136 patients had primary coxarthrosis, 6 sequelae after hip fractures, 2 sequelae after congenital dislocation of the hip, and another 6 patients had mechanical loosening of a previous hip arthroplasty.

Six patients were excluded because of a postponed operation, a concomitant bilateral operation, or other procedures than THA. This left 144 patients for analysis (Table 1).

The three prophylactic groups did not differ concerning previous symptoms of swollen legs, frequency of leg ulcers, eczema, malignancy, varicose veins, previous DVT, previous pulmonary embolism, or cardiovascular disease, nor in preoperative hospitalization time.

Type of prophylaxis

All the patients received dextran-70 prevention as routinely used at our hospital: Macrodex® 6 percent

Table 1. Clinical material left for analysis

	Regular dextran	Additional compression stockings	Additional preoperative dextran
No. of patients	48	49	47
Age (mean *SD*)	66 *12*	67 *10*	66 *13*
Sex (m/f)	22/26	19/30	16/31
Operated on side (L/R)	20/27	23/26	28/19
Broca's index[a]	1.0	1.0	1.0

[a] Body weight (kg)/body height (cm) –100.

in NaCl (Pharmacia AB, Uppsala, Sweden), 500 mL peroperatively and 500 mL during the first 12 h postoperatively. Another unit of 500 mL was given on the first and third postoperative days. If the peroperative blood loss exceeded 2 L, another 500 mL was given on the second postoperative day. Maximally 15 min before the initial infusion of dextran 70, 10 mL of monovalent hapten dextran (15 percent dextran 1, mol. weight 1000, Promten®, Pharmacia AB, Uppsala, Sweden) was injected i.v.

Group 1 was given only the regular dextran prophylaxis.

Group 2 had as additional prophylaxis bilateral, graded compression stockings (Comprinet S Reg/ BDF Hamburg-West Germany) of full length and individually fitted. The stockings were applied on the evening before the operation according to the manufacturer's recommendation. The stocking on the operated on leg was rolled down to the knee during the operation. Both stockings were left on for 14 days, and were only removed for patient cleaning. Two patients discontinued wearing the stockings after 2 days because of discomfort.

Group 3 had additional preoperative dextran administered for 2–3 hours on the evening before the operation after having previously received hapten dextran.

Diagnostic methods

The ^{125}Fibrinogen Uptake Test (FUT) was performed daily according to Kakkar et al. (1969), but slightly modified (Bergquist et al. 1973). The measurements were made during a 10-day period. The thyroid uptake of ^{125}I was blocked by a daily oral dose of 200 mg KI or, if necessary, 150 mg of NaI given i.v. for 10 days starting before the first injection of ^{125}I-fibrinogen. A dose of 3.7 Mega B of ^{125}I-fibrinogen was then given i.v., and was followed by a preoperative measurement. The second measurement was performed on the first postoperative day, and later every second day for 1 week. If the test results were positive, FUT was carried out every following day to establish the diagnosis. If the activity was less than 10,000 counts/min over the heart, the dose of ^{125}I-fibrinogen was repeated. The thigh of the operated on leg was not evaluated by FUT. An uptake increase of 20 percent or more as compared with the adjacent points or the corresponding point of the opposite leg was considered diagnostic for thrombosis. The data were analyzed blindly concerning the type of prophylaxis.

Ascending phlebography of the operated on thigh was made on the 10th postoperative day by injecting 100 mL of Isopaque Amin® 150 g Iodine/mL (Nycomed) into a dorsal foot vein according to Brodelius et al (1971). Intraluminal filling defects of the popliteal and femoral veins were considered diagnostic for thrombosis. Fourteen patients refused to participate in the phlebographic tests or were excluded because of technical failures of the investigations. At the completion of the study, the radiographs were reevaluated blindly as regards the type of prophylaxis.

The operating time and number of days of hospitalization were noted, as were peroperative and postoperative complications. The peroperative blood loss was recorded by the anesthesiologist. The postoperative bleeding was calculated by measuring the number of transfused blood units as well as the suction drains. The drains were extracted on the second day if less than 100 mL had emptied during the previous 12 hours or otherwise on the third day.

A clinical follow-up of all the patients was made 30 days postoperatively regarding postoperative complications and fatal pulmonary embolism.

The Student's *t*-test was used with levels of significance marked * = $P < 0.05$, ** = $P < 0.01$.

Results

Postoperative complications

Two patients (1 percent) died within 30 days, both of myocardial infarction. The autopsies did not reveal any thromboembolic complications.

No anaphylactic reaction to dextran was observed, nor were there any signs of cardiac failure due to an overload during the dextran administration.

Table 2. The frequency of DVT in the three prophylactic groups as measured by the fibrinogen uptake test (FUT) and phlebography. The figures relate to no. of DVT/no. of patients

	Conventional dextran		Additional compression stockings		Additional preoperative dextran
Nonoperated on leg					
FUT lower leg	4/47		2/49	*	11/46
FUT thigh	9/47	**	1/49		4/46
total	13/47	**	3/49	**	15/46
Operated on leg					
FUT lower leg	13/47	*	5/49		8/46
Phlebography thigh	9/46		5/44		4/46
Overall frequency	21/46		13/44	*	24/46

* = $P < 0.05$, ** = $P < 0.01$.

Table 3. The operating time, peroperative and postoperative bleeding, and transfused no. of blood units postoperatively. Mean *SD*

	Conventional dextran		Additional compression stockings		Additional preoperative dextran	
No. of patients	48		49		47	
Operating time (min)	137	*57*	123	*37*	138	*40*
Peroperative bleeding (mL)	1230	*770* **	870	*360* **	1290	*800*
Postoperative bleeding (mL)	800	*370*	900	*520*	820	*460*
Transfused blood units	3.8	*2.4*	3.2	*2.2*	4.5	*3.4*

** = $P < 0.01$.

Bleeding complications occurred in 8 patients. Two had a wound hematoma, which did not interfere with the wound's healing. Three patients had bleeding from gastrointestinal ulcers, one of which was induced by heparin treatment of DVT. Two patients had a transient anemia from hemolysis and fibrinolysis, respectively. Two patients had wound infections, and 9 others had infections of the gastrointestinal or respiratory tract. All healed uneventfully.

Two patients, both given conventional dextran only, had clinical symptoms and scintigraphic signs of pulmonary embolism and were treated with heparin and warfarin according to the regular routine.

All the complications were uniformly distributed in the three groups.

Thrombosis incidence

The overall frequency of DVT in both legs was 13/44 (0.30; $P < 0.05$) in the stockinged group as compared with 21/46 (0.46) in the regular dextran group and 24/46 (0.52) in the group with additional preoperative dextran.

The frequency of DVT was considerably lower ($P < 0.01$) in the nonoperated on leg when comparing the stockinged group with the other two groups and also lower ($P < 0.05$) in the calf of the operated on leg when comparing the stockinged group with the one with conventional dextran (Table 2).

The ascending phlebographies did not demonstrate any differences in femoral DVT. Seven patients, about equally divided up in the three groups, had a solitary DVT located in the operated on thigh but no FUT-diagnosed DVT.

The duration of surgery or period of hospitalization did not differ between the groups.

The peroperative blood loss was on an average 350 mL lower in the stockinged group ($P < 0.01$; Table 3).

Discussion

Stockings with graded compression extending from the ankle to the groin decrease the incidence of postoperative DVT (Holford 1976, Scurr et al. 1977, Barnes et al. 1978, Törngren 1980, Ishak and Morley 1981, Allan et al. 1983, Nicolaides et al. 1983, Bergqvist and Lindblad 1984). The only previous studies with compression stockings along with dextran prophylaxis were made by Öhlund et al. (1983) in mixed hip surgery and by Bergqvist and Lindblad (1984) in elective abdominal surgery, in which a definitive potentiating effect was obtained by the combination.

Our results accord with previous studies concerning a decreased frequency of all DVTs after using compression stockings. In the present study, by combining graded compression stockings with dextran, a decrease of DVT was obtained especially in the nonoperated on leg, as well as a substantial decrease in the amount of peroperative blood loss.

Femoral DVT of the operated leg in hip athroplasty is far more frequent than in the nonoperated

leg, as demonstrated by bilateral ascending phlebography (Nillius and Nylander 1979). Dextran prevention in that study was 500 m peroperatively and 500 m on the second postoperative day, and the frequency of femoral DVT in the operated leg 25/56 (0.44).

In a previous trial (Fredin et al. 1984), dextran was given exactly as in the present study. The frequency of femoral DVT in the operated on leg then was 11/50 (0.22) compared with our present results of 9/46 (0.20) with conventional dextran, 5/44 (0.11) with additional graded compression stockings, and 4/46 (0.09) with additional preoperative dextran.

Consequently, an increased dose of dextran, prolonged time of administration, and additional wearing of compression stockings seem to decrease quite considerably the frequency of femoral DVT in the operated on leg.

The reason for a reduced peroperative blood loss in the stockinged group may well be a result of a reduced peroperative pooling of blood in the leg (Sigel et al. 1975).

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