

PROPHYLAXIS OF DEEP VEIN THROMBOSIS AFTER MAJOR ABDOMINAL SURGERY

*Comparison between Dihydroergotamine-Heparin and Intermittent Pneumatic Calf Compression
and Evaluation of Added Graduated Static Compression*

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(Submitted for publication February 5, 1986. Accepted May 6, 1986)

Abstract. In a prospective, randomized study on 114 patients undergoing major abdominal surgery, the prophylactic effect of dihydroergotamine (DHE) combined with low-dose heparin (LDH) against postoperative deep vein thrombosis (DVT) was compared with that of peroperative intermittent pneumatic calf compression (IPCC). The additive effect of graduated pressure stockings was also studied. By randomizing a stocking to the right or left leg in each patient. The ¹²⁵I-fibrinogen test was used to diagnose DVT. The incidence of postoperative DVT was significantly lower in the DHE-LDH than in the IPCC group (4% v. 19%). In the IPCC group the incidence of postoperative DVT was equal in legs with and without stocking. The study thus indicated that DHE-LDH is more effective than peroperative IPCC in preventing DVT after major abdominal surgery, and that graduated pressure stockings do not enhance the prophylactic effect of peroperative IPCC.

Key words: deep vein thrombosis, major abdominal surgery, dihydroergotamine-heparin, intermittent pneumatic calf compression, graduated compression stockings

Thromboembolism after major surgery is a serious complication, and several pharmacologic and mechanical methods for prophylaxis have been described. Refinements of these methods are desirable, however, as thromboembolic complications still occur, and some methods involve a certain risk of bleeding or allergic complications.

As the pathogenesis of venous thrombosis is multifactorial, combination of prophylactic methods with different modes of action seems logical. Thus the combinations of low-dose heparin (LDH) with dihydroergotamine (DHE) (9, 24) or with graduated compression stockings (22, 23) enhanced the preventive action of the single method. Intermittent pneumatic calf compression (IPCC) during surgery has been reported to give adequate prevention (5, 18, 19), as has use of graduated compression stock-

ings during and after surgery (1, 8, 20). Theoretically, combination of these methods should be favourable, with minimal risk of side effects. DHE-LDH has been reported as the most effective prophylaxis against deep vein thrombosis (DVT) after major abdominal surgery (14, 24), but low-dose heparin involves risk of bleeding complications (17).

The aims of this investigation were to compare the prophylactic effect of DHE-LDH and peroperative IPCC on the incidence of DVT after major abdominal surgery and to evaluate possible additive effect of graduated compression stockings.

PATIENTS AND METHODS

The study comprised 114 patients older than 50 years undergoing operation for benign or malignant abdominal disease. The magnitude of planned surgery was cholecystectomy or more advanced. Patients with hypersensitivity to iodine, or who were receiving anticoagulant therapy or had symptoms or signs of arterial insufficiency (which may influence interpretation of the ¹²⁵I-fibrinogen test), advanced angina pectoris or preoperatively immobilizing disorder were not accepted.

The patients were randomly allocated (sealed envelopes) to prophylaxis against postoperative DVT with DHE-LDH or with IPCC. DHE-LDH (0.5 mg+5000 IU, Sandoz, Täby, Sweden) was injected subcutaneously 2 hours before surgery and subsequently twice daily until the patient was fully mobilized. IPCC was given during surgery, beginning immediately after induction of anaesthesia. The equipment was a Flowpulse model 1100 (Huntleigh, Luton, UK) set to give an inflation time of 5 s up to a pressure of 40 mmHg, which was held for 15 s and followed by a deflation time of 5 s. A new cycle was started after a 40-s resting period. Additionally, each patient in both groups wore a graduated compression stocking of thigh length (American C.A.R.E., American Hospital Supply, McGaw Park, Ill. USA), randomly allocated to right or left leg. The stocking was applied before surgery and was worn until the patient was fully mobilized.

Table I. Age, sex, body mass index and operating time

	No. of cases	Age (years)		Body mass index	Sex		Operating time (min)	
		Mean \pm SD	Range		M	F	Median	Range
DHE-LDH	54	64.2 \pm 7.8	50-83	25.1 \pm 3.6	29	25	148	45-360
IPCC	54	67.8 \pm 7.8	50-85	25.5 \pm 3.9	22	32	135	25-420

Six patients who entered the trial were excluded from the analysis of results. Two of them (DHE-LDH group) received dextran for volume expansion postoperatively. IPCC was not performed in two patients allocated to that group. One patient received heparin after surgery, and in another the 125 I-fibrinogen test was not satisfactorily performed. Thus 54 patients remained in each group. Table I lists age, sex, body mass index and operation time in the two groups. The types of surgery and the numbers of patients with malignant disease are shown in Table II.

DVT was diagnosed with the 125 I-fibrinogen test, as previously described (12), principally according to the method of Flanc et al. (7). The criterion for DVT was uptake increase of 20% or more at two consecutive measurements and in comparison with adjacent points. Measurements were started preoperatively and continued on postoperative days 1, 3, 5, 7 and 9 (or daily if positive) or, if the patient was discharged before day 9, for as long as hospitalization lasted.

The body mass index was calculated (10) as weight (kg) divided by the square of the height (m).

Peroperative bleeding was calculated from the amount of blood in suction drainage and the estimated content of blood in the swabs.

The investigation was approved by the Ethical Committee of the Faculty of Medicine at Umeå University. Prior consent to participate in the trial was obtained from all the patients.

Statistical analyses were performed with the chi-square test with Yates' correction, and with the Mann-Whitney U test. p -value < 0.05 was regarded as statistically significant.

RESULTS

All clinical variables were comparable in the two groups (Table I), and there were no major differences between the groups in types of surgery or numbers of patients with malignant disease (Table II). No patient died. Postoperative DVT was significantly ($p < 0.05$) more common in the IPCC group than in the DHE-LDH group (Table III). One DVT in each group was found in the thigh, while the others were in the calf. Bilateral thrombi were found in one DHE-LDH patient and in three from the IPCC group. In the DHE-LDH group, 27 patients wore the stocking on the right leg and 27 on the left. The corresponding figures in the IPCC group were 32 and 22. The incidence of thrombosis did not sig-

nificantly differ between legs with or without graduated pressure stockings (Table III).

Reoperation because of early postoperative bleeding was performed in two cases. These were the DHE-LDH patients mentioned as excluded from the analysis of postoperative DVT because they received dextran for volume expansion. Otherwise no major bleeding complication occurred. Bleeding during surgery showed no significant intergroup difference (Table IV). No leg complication arose that could be attributed to IPCC or wearing of graduated pressure stocking. All patients tolerated wearing of the stocking as scheduled for the experiment.

DISCUSSION

When compared with untreated controls, IPCC has not been consistently reported as effective against development of postoperative DVT (4). The prophylactic effect seems to be better when IPCC is extended into the postoperative period (3, 6) and when sequential compression is used (15). With this regimen, IPCC was reported to be at least as effective as LDH (3, 6, 15). But in tests of preoperative and postoperative compression when planning this study, we found that IPCC caused considerable discomfort to the patient in the period after surgery. Furthermore,

Table II. Type of surgery and incidence of malignant disease

Operations	DHE-LDH		IPCC	
	Total	With malignancy	Total	With malignancy
Colorectal	17	10	19	14
Gastric	11	4	6	3
Biliary	23	1	24	0
Abdominal exploration	3	3	3	3
Miscellaneous	0	0	2	1
Total	54	18	54	21

Table III. DVT incidence (GPS=graduated pressure stocking)

Groups	DVT/ no. of patients	DVT/ legs with GPS	DVT/ legs without GPS
DHE-LDH	2/54 (4%)	1/54	2/54
IPCC	10/54 (19%)*	7/54	6/54

$p < 0.05$.

Table IV. Estimated bleeding during surgery

Prophylaxis	No. of cases	Peroperative bleeding (ml)		
		Mean	Median	Range
DHE-LDH	54	690	450	Minor - 2 800
IPCC	54	580	300	Minor - 3 900

postoperative IPCC was impracticable in the wards and interfered with mobilization of the patients.

No untreated control group was included in the present study, but previously we found the incidence of DVT after major abdominal surgery in our department to be 31% without specific prophylaxis (13). That series, however, comprised patients undergoing abdominal surgery more advanced than simple cholecystectomy, which was included in the present study. The two series therefore were not strictly comparable. It is doubtful if IPCC provided any prophylactic effect in our patients, as the lower incidence of DVT in the IPCC group (19%) might be explained by the differing composition of the series. In the present study, however, the ¹²⁵I-fibrinogen test showed significantly lower incidence of postoperative DVT in the DHE-LDH than in the peroperative IPCC group (4% v. 19%). The incidence of DVT after major abdominal surgery with DHE-LDH prophylaxis in our study accorded with previous reports (2, 9, 14).

Earlier authors (16) used intermittent sequential pneumatic compression of the legs during surgery and for 72 hours postoperatively, followed by graduated compression stockings. This regimen was at least as effective as LDH against postoperative DVT. However, as no group received only intermittent compression, no conclusion is possible concerning additive effect of the stockings. In the present study, the leg without a stocking functioned as a control for the stocking leg in the same patient. In the IPCC group, the incidence of diagnosed thrombus was equal in legs with and without stocking. Despite the

relatively small numbers of patients and of thrombi in our series, it seems improbable that a significant difference would be found in a larger group. We therefore conclude that graduated pressure stockings do not seem to enhance the prophylactic potentiality of peroperative IPCC as regards DVT after major abdominal surgery.

In the DHE-LDH group thrombosis appeared in stockings as well as non-stockinged legs. However, the number of thrombi diagnosed is too small to permit conclusions. Clearly a very large number of patients is required for evaluation of this question. Probably both DHE and graduated static compression produce a thromboprophylactic effect mainly by increasing the velocity of venous blood flow in the legs (11, 21). A synergistic action thus seems doubtful. Since the stockings presumably had no additive effect, the results of this study seem to warrant the conclusion that DHE-LDH apparently is more effective than peroperative IPCC in preventing DVT after major abdominal surgery.

An increased number of surgical bleeding complications has been reported in connection with LDH (17). We found no significant difference between the DHE-LDH and the IPCC group in the analysis of peroperative bleeding. This agrees with previous reports analyzing bleeding complications during or after surgery when DHE-LDH was used for prophylaxis of postoperative DVT (2, 9, 14).

ACKNOWLEDGEMENTS

This work was supported by grants from the Swedish National Association against Heart and Lung Diseases and the

Medical Faculty of the University of Umeå. The skilful assistance of Mrs Katarina Engman is greatly appreciated.

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