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CALF COMPRESSION FOR PREVENTION OF THROMBOEMBOLISM FOLLOWING HIP SURGERY

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A prospective, randomized trial of the effect of graded compression of the calf was done in 62 patients operated on electively for hip disease. After total hip arthroplasty, compression reduced the number of positive fibrinogen uptake tests by two-thirds, significant only in males, who seem to run a higher risk of thrombosis than females.

Key words: hip prosthesis; postoperative complications; prevention; thromboembolism

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In orthopaedic surgery, prophylaxis against postoperative thromboembolism still generates more questions then definite answers. Even if total mortality has been reduced, postoperative thromboembolism still exceeds the other major complication: deep infection. In Sweden, where Dextran-prophylaxis is the rule, mortality in pulmonary embolism after elective hip surgery is around 0.7%. More effective general prophylaxis may increase the risk of bleeding (Coventry 1973).

Mechanical methods for prophylaxis have a great advantage – the lack of serious complications. A trial to evaluate the simplest of these mechanical methods, graded elastic compression, therefore seemed reasonable.

PATIENTS AND METHODS

The study was carried out from November 1978 to May 1979. All patients over 50 years accepted for elective hip surgery were randomized to two groups: graded compression stockings (TED®) or none. Randomization was done on 63 patients, of whom 48 had total hip arthroplasties, eight endoprostheses, three Wagner cup-prostheses and three AO- or McLaughlin plating. Two-thirds of the patients had spinal or epidural anaesthesia.

All patients had Dextran-prophylaxis, with 500 ml Dextran 70 given at induction of anaesthesia and on the 2 days following operation.

Fibrinogen uptake test (FUT)

Measuring was done over a period of 10 days (day of operation = day 1), on average 4–5 times per patient. Significant uptake was determined using the 20% criterion (Kakkar 1977). A NaI-detector with a modified collimator (Forsberg 1975) was used. The spectrometer was tested, before every measurement, against a reference isotope, and background activity was also noted.

Statistical analysis

Student's *t*-test with one-sided hypothesis was used. Calculation of type I (alpha) and type II (beta) errors was done (Freiman et al. 1978).

RESULTS

One patient operated on electively died in the fourth postoperative week of septic peritonitis secondary to a perforated ulcer.

Effects of graded compression

The end-point was a significant positive isotope uptake. The results are shown for the total elective material (Group I) and for total hip arthroplasties alone (Group III). Patients without predisposing factors for postoperative thrombosis are given separately as Group II and IV (Tables 1 and 2). All four groups were also analysed separating females and males (Table 3).

Table 1. Frequency of significant Fibrinogen Uptake Tests in patients undergoing elective operative procedures

	With TED®	No TED®	P	1-β
I. All elective patients n = 62 Males = 30	7/31	15/31	0.05	69%
II. All elective patients (patients with predisposing factors excluded) n = 52 Males = 26	6/27	11/25	0.05	51%

Table 2. Frequency of significant Fibrinogen Uptake Tests in patients undergoing total hip arthroplasty

	With TED®	No TED®	P	1-β
III. All patients undergoing THA n = 48 Males = 28	6/25	14/23	0.01	63%
IV. All patients undergoing THA (patients with predisposing factors excluded) n = 39 Males = 24	5/22	10/17	0.05	76%

Table 3. Frequency of significant Fibrinogen Uptake Tests in patients

	With TED®	No TED®	P	1-β
All elective patients				
Males n = 30	5/15	11/15	0.05	75%
Females n = 32	2/16	4/16	N.S.	22%
All elective patients (patients with predisposing factors excl.)				
Males n = 26	5/15	8/11	0.05	67%
Females n = 26	1/12	3/14	N.S.	23%
All patients undergoing THA				
Males n = 28	4/14	10/14	0.05	75%
Females n = 20	2/11	3/9	N.S.	37%
All patients undergoing THA (patients with predisposing factors excl.)				
Males n = 24	4/14	7/10	0.05	68%
Females n = 15	1/8	3/7	N.S.	35%

A high frequency of positive FUT's was found when graded compression was not used, especially after total hip arthroplasty (Table 2) and most pronounced in males (Table 3). Graded compression reduced the frequency in the total elective material by 53% ($p < 0.05$) and after total hip arthroplasty alone by 60% ($p < 0.01$). Even patients without predisposing factors showed a significant decrease in the total hip arthroplasty group ($p < 0.05$) (Tables 1 and 2). Although graded compression reduced the frequency of isotope thrombosis, it did so significantly only in males ($p < 0.05$). The difference between males and females in the incidence of postoperative thrombosis was significant ($p < 0.01$). The frequencies after graded compression was applied – just above 20% – were almost the same in all four groups (Tables 1 and 2).

DISCUSSION

Postoperative thrombosis after hip surgery arises in two different settings (acute and elective surgery) and seems to constitute two different diseases (distal and isolated proximal thrombosis) with perhaps two different modes of medical prophylaxis (Bergqvist et al. 1979). Distal thrombotic disease, with calf-thrombosis as the main expression, has been claimed to be the result of stasis and general trauma effects, while proximal disease is due to local factors (Stamakatis et al. 1977, Nillius 1978).

Several authors have shown a beneficial effect of different mechanical measures combating stasis (Flanc & Kakkar 1969, Arnoldi 1976, Roberts 1977, Nicolaides et al. 1980), even after major orthopaedic surgery (Barnes et al. 1978, Ischak & Morley 1981).

This study has shown a significant reduction in postoperative thrombosis, most pronounced after total hip arthroplasty and especially in males. After total hip arthroplasty, where the general trauma effects must be considered greater than in the material as a whole, even patients without predisposing factors showed a significant decrease. It thus seems possible that graded compression reduced the effects of the greater outflow of tissue-thromboplastin even following the most extensive prosthesis surgery.

When the material was taken as a whole, a significant difference in thrombus-incidence was noted between the sexes, with a much higher incidence in males. However, the power of the tests might indicate that the null-hypothesis for females could be rejected in a larger material.

The sex difference in postoperative thrombosis may also, to some extent, explain why some proposed forms of prophylaxis have shown an effect in males only (Harris et al. 1977).

Recently, another aspect of the relation between complications to non-mechanical prophylaxis (apart from an increased bleeding tendency) and deep infection has emerged. The phagocytic and opsonic functions of the RES seem to be partially blocked by at least some agents used for medical prophylaxis (Lahnborg et al. 1976, 1979). It is possible that this means that medical treatment and non-mechanical prophylaxis should be kept to a minimum. It also supports the clinical value of mechanical methods of prophylaxis.

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