

Prevention of venous thromboembolism in North America: Results of a survey among general surgeons

Joseph A. Caprini, MD, Juan I. Arcelus, MD, PhD, Kevin Hoffinan, B A ,
Tanya Mattern, BS, Maureen Laubach, RVT, Gail P. Size, RVT, Clara I.
Traverse, MD, PhD, and Robert Coats, BS,
Glenview and Chicago, Ill.

Purpose: The purpose of this study was to analyze current attitudes toward the prevention of postoperative venous thromboembolism among North American general surgeons.

Methods: A survey regarding awareness of the problem of venous thromboembolism and preferred modalities of prophylaxis was sent to 3500 randomly selected Fellows of the American College of Surgeons.

Results: A total of 1018 (29.1%) surveys was returned. Most of the responding surgeons consider venous thromboembolism a serious health problem. Ninety percent of the surgeons use prophylaxis against venous thromboembolism routinely. The most frequently used modalities are intermittent pneumatic compression, low-dose heparin, and elastic stockings. A combination of physical and pharmacologic methods is used by one fourth of respondents, and only 50% start pharmacologic prophylaxis before the surgical procedure. The thrombosis risk factors that are most frequently considered by surgeons when deciding about using prophylaxis are history of venous thromboembolism, immobility, and length of operation.

Conclusions: North American surgeons who responded to this survey are well aware of the problem of venous thromboembolism and their approach to prevention has been significantly modified in the last 10 years. Compared with similar European surveys this survey reveals a higher implementation of physical methods such as intermittent pneumatic compression and elastic stockings. Because of the limited response rate and possibility of sampling bias, these findings should be interpreted with caution. (J VASC SURG 1994;20:751-8.)

Postoperative venous thromboembolism (VTE) represents a serious threat to patients undergoing a surgical procedure. It is estimated that 25% of patients undergoing an abdominal surgical procedure experience deep vein thrombosis in the legs, as detected by objective diagnostic methods, if anti-thrombotic prophylaxis is not provided. On the other

hand, the rate of postoperative fatal pulmonary embolism in this population approaches 1%.^x

During the past 2 decades a large number of studies and subsequent metaanalyses of the literature have clearly demonstrated that several modalities of prophylaxis, pharmacologic and physical, are able to significantly reduce the rate of postoperative VTE.^{1,5} In 1986 the U.S. National Institutes of Health held a consensus conference that supported the use of some prophylactic methods and provided guidelines for their indication in different surgical populations. Because the last survey involving North American surgeons was conducted more than 10 years ago,⁶ the influence of that conference on clinical surgical practice is not well known. The purpose of this study was to assess current attitudes toward postoperative VTE prevention by means of a survey addressed to a large number of general surgeons from North America.

From the Department of Surgery, The Glenbrook Hospital, Glenview; and Northwestern University Medical School,

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Joseph A. Caprini, MD, Department of Surgery,
The Glenbrook Hospital, 2100 Pfingsten Rd., Glenview, IL
60025.

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Table I. Reasons for not using specific prophylaxis

Reason	N	(Percent of total)
Low incidence of VTE	142	(14)
Available methods not fully effective	45	(4)
Risk of complications	58	(5)
Too costly	23	(2)

VTE, Venous thromboembolism.

Table II. Modalities of prophylaxis used

Modality	N	(Percent of respondents)
Elastic stockings	623	(61)
Short-leg pneumatic compression	368	(36)
Long-leg pneumatic compression	401	(39)
Low-dose heparin (fixed doses)	610	(60)
Low-dose heparin (adjusted doses)	126	(12)
Aspirin	175	(17)
Oral anticoagulants	116	(11)
Dextran	51	(5)
Combined (physical-pharmacologic)	268	(26)

Table III. Characteristics associated with the main prophylactic methods

Modality	Safety	Effectiveness	Simplicity	Cost effectiveness
Heparin	3.4	4.1	3.6	3.6
Warfarin (Coumadin)	2.5	3.5	2.5	3.1
Stockings	4.6	2.7	4.5	3.5
IPC	4.5	3.8	3.8	3.3

IPC, Intermittent pneumatic compression.

* Results expressed as average of the reported results (from 1 to 5).

METHODS

Between December 1992 and April 1993, a questionnaire was sent to 3500 general surgeons from the United States and Canada who were Fellows of the American College of Surgeons. The list with surgeons' names and addresses was obtained from the American College of Surgeons after a computer-based randomized search for Fellows who were listed as general surgeons was performed. The survey consisted of 17 questions regarding awareness of the problem of VTE and its risk factors, timing of prophylaxis, and preferred modalities in general and specific clinical scenarios (Appendix 1). All surveys were mailed with one return addressed, stamped envelope.

The statistical analysis of the results consisted of the chi-square test for proportions. The level of significance was set at 0.05.

RESULTS

By July 15, 1993, replies were received from 1018 surgeons (a response rate of 29.1%). Eighty-three percent of the respondents considered VTE a serious or very serious problem, and 86% used specific prophylactic measures, apart from early ambulation, in their patients. Conversely, 146 (14%) surgeons used no prophylaxis (Table I).

The preferred prophylactic modalities were intermittent pneumatic compression, low-dose heparin,

Table IV. Risk factors that are considered most critical when deciding to use prophylaxis

Risk factor	N	(Percent)
Previous VTE	870	(85)
Immobilization	454	(44)
Duration of operation	441 383 330	(43) (37) (32)
Hypercoagulability Obesity		
Malignancy	299	(29)
Age	250	(25)
Pelvic surgical procedure Varicose veins	224 104	(22) (10)

VTE, Venous thromboembolism.

and elastic stockings (Table II). Regarding the timing of prophylaxis, pharmacologic or physical methods were started before the operation by 54% and 42% of respondents, respectively. They were continued after the operation by 70% and 64% of surgeons, respectively.

Some characteristics associated with the main prophylactic modalities such as safety, efficacy, sim-

plicity of use, and cost-effectiveness are detailed in Table III. Seventy-three percent of surgeons have modified their approach to VTE prophylaxis in the past 10 years. The reasons for doing so were the availability of improved physical (54%) and pharmacologic methods (14%), increased awareness of the

Table V. Recommended modalities in specific clinical scenarios (%)

Age, sex	Modality	Physical	Pharmacologic	Stockings	IPC	Heparin	Other
55 F	Conventional cholecystectomy through laparotomy	36	21	20	6	9	
75 M	Colon resection for carcinoma	4	11	22	9	38	
24 F	Biopsy for breast adenoma	94	2	1	1	1	
47 F	Laparoscopic cholecystectomy	38	16	29	2		
78 F	Laparoscopic cholecystectomy	1	2	12	10	65	
60 M	Inguinal hernia repair, epidural anesthesia	53	27	13	2	4	
54 F	Appendectomy for acute appendicitis, obesity	22	20	24	7	17	

Combination indicates combination of physical and pharmacologic modalities. *IPC*, Intermittent pneumatic compression; *VTE*, venous thromboembolism.

problem (40%), and concerns about liability issues (21%).

Risk factors considered more important when deciding about adopting prophylaxis are presented in Table IV. The recommended modalities for specific clinical situations are depicted in Table V. The results regarding which is the first diagnostic test ordered to confirm a suspected deep vein thrombosis were B-mode ultrasonography (64%) followed by handheld Doppler (17%), contrast venography (12%), and outflow plethysmography (7%).

Most of the responding surgeons performed general abdominal surgical procedures (83%), abdominal wall hernia surgical procedures (66%), colorectal surgical procedures (60%), and laparoscopic surgical procedures (56%). Only 10% performed vascular procedures. The capacity of the hospitals where surgeons practiced was fewer than 200 beds in 30% of the cases, between 200 and 500 beds in 46%, and more than 500 beds in 24%. Forty-nine percent of respondents worked in a teaching hospital, and 50% had an academic appointment. Twenty percent had been in practice for less than 10 years, 34% between 10 and 20 years, 28% between 21 and 30 years, and 18% more than 30 years. Most of the respondents practiced in cities with a population less than 100,000 (41%) inhabitants, and 37% did so in areas between 100,000 and 1 million.

The use of prophylaxis was significantly higher among surgeons practicing in teaching hospitals (91%) than those who did not (84%) ($p < 0.05$). However, the implementation of prophylaxis did not show significant differences related to surgeons' academic appointment ($p = 0.24$), years in practice

($p = 0.07$), hospital capacity ($p = 0.7$), or city population ($p = 0.5$).

DISCUSSION

Several surveys performed in different countries during the past 10 years reveal marked differences among general surgeons in their attitudes toward

VTE prevention.^{6,11} Furthermore, surgeons' preferences have changed through the years as new

methods have developed. This has been documented by Bergqvist,¹³ who analyzed the results of three different surveys conducted in Sweden within 10 years. This author reported an increase in the proportion of clinics using some form of prophylaxis, from 81% in 1977 to 1978 to 100% in 1987 to 1988.

The 29% response rate obtained in our study is very similar to that reported before in the United States in general (30%),⁶ in orthopaedic surgery (19%),⁴ and more recently, in Australia and New Zealand (28%).¹² Such a low response rate is of concern, because it might lead to notable bias when analyzing the results, such as self-selection of respondents. One could argue that those returning the survey were biased either by believing in prophylaxis or were interested in having their opinion heard. The views of most physicians were not heard, because they chose to ignore the survey. In addition, surgeons who are not very knowledgeable about prophylaxis might have been less likely to respond. As shown in Table VI, surveys addressed to surgical departments^{7,9,11,13} yielded higher response rates than did those addressed to individual surgeons.^{6,8-12} Nevertheless we hoped that by addressing the questionnaires to individual surgeons, we would obtain a

Table VI. Summon' of surveys on prevention of venous thromboembolism

Author	Year	Country	1982 (%)	1985 (%)	Comments
Bergqvist	1980	Sweden	94	81	Dextran 70 the preferred method
Morris	1980	United Kingdom	75	25-62	Heparin preferred
Conti	1982	United States	30	43-79	Heparin preferred. included clinical scenarios
Kobe	1982	Sweden	83	74-83	Heparin preferred
Bergqvist	1985	Sweden	96	98	Dextran 70 remained the dominant method
Arcelus	1988	Spain	63	80	Heparin preferred
Bergqvist	1990	Sweden	96	100	Increased use of heparin and decreased use of dextran
Fletcher	1992	Australia and New Zealand	28.5	63	Much use of physical methods
Caprini	This study	United States	29	86	See text

more reliable estimate of the average general surgeon's routine clinical practice. Another shortcoming of this survey is the fact that most surgeons completed the questionnaire without researching individual charts or patient records. What is the exact percentage of a surgeon's patients receiving each prophylactic modality, and for how long? Unfortunately it is difficult to obtain this type of information without a thorough review of individual records.

Most surgeons responding to our survey are well aware of the problem of postoperative VTE. This is reflected by 86% of respondents currently using specific prophylactic methods in their patients, compared with 73% in 1982.⁶ Such a rate is similar to that found in some European studies^{9,11} and is higher than in Australia and New Zealand¹² and the United Kingdom⁸ (Table VI).

Prophylaxis was used in a significantly higher proportion by surgeons practicing in teaching hospitals. Yet statistically significant differences were not associated with other variables such as years in practice, academic appointment, or capacity of the hospital.

It is interesting to note that very few respondents did not use prophylaxis because of the risk derived from its complications or because they considered the incidence of VTE too low to justify the adoption of prophylaxis (Table I). Whereas 73% of surgeons expressed doubts about the efficacy of available preventive methods in 1982,⁶ this percentage was reduced to 5% in this survey. This probably reflects the influence of the large number of studies published in recent years demonstrating the efficacy of prophylaxis.

It is important to realize that the proportion of surgeons expressing in a survey that they implement prophylaxis does not necessarily parallel the proportion of patients who actually receive such prophylaxis.

For example, though the last Swedish survey indicated that 100% of the general surgical departments used prophylaxis, only 37% of patients who underwent a surgical procedure were receiving prophylaxis.¹⁵ Two studies conducted in the United States, one prospective¹³ and another retrospective,¹⁶ found that the proportion of patients who underwent a surgical procedure and were given prophylaxis was around 35%.

In general the preferred thromboprophylactic modalities were elastic stockings, low-dose heparin, and intermittent pneumatic compression (Table II). These results are similar to those from the 1982 American survey.⁶ However, there is an increase in the frequency of use of intermittent pneumatic compression. The high implementation of physical methods in North America has also been reported in Australia and New Zealand¹² and the United Kingdom⁸ but not in other European countries.^{9,11,13}

It is surprising to note the relatively high proportion of general surgeons who were using aspirin for their patients undergoing general surgical procedures, despite the National Institute of Health consensus conference reservations about the benefits associated with the use of this drug.¹⁷ Similar high rates of aspirin use have been reported in other recent surveys.^{12,13}

As shown in Table III, respondents considered heparin and intermittent pneumatic compression to be the most effective methods and stockings less effective. Physical methods were rated as safe and simple to use, whereas oral anticoagulants obtained low average ratings. Regarding cost-effectiveness, heparin and stockings obtained the best scores.

Most responding surgeons have modified their approach to VTE prevention in the last 10 years. The main reasons for this change are the availability of improved physical methods followed by increased

awareness of the problem. It is surprising that only 14% modified their practice because of improved pharmacologic agents and 21% because of concerns about liability. When this survey was mailed, low molecular weight heparin was not available in North America for clinical use in general surgical procedures. These agents have gained rapid acceptance among European surgeons in recent years because of better bioavailability and proven clinical efficacy.^{13,15,19}

Regarding risk factor assessment, the low percentage of surgeons who consider age an important risk factor is surprising, because a number of studies show a clear association between advanced age and an increased risk of having VTE.^{20,22}

Apart from general preferences regarding the use of different prophylactic modalities in patients undergoing general surgical procedures, we were very interested in assessing the surgeons' options in specific clinical scenarios, including patients at high, moderate, and low risk. As shown in Table V two thirds of the respondents would implement prophylaxis for patients in their 50s undergoing conventional cholecystectomy through laparotomy. A noticeable preference for physical modalities for this surgical population exists, and only 6% of surgeons selected heparin as a single prophylactic modality. For patients of similar age undergoing the same procedure through the laparoscopic approach, a similar proportion of patients would be protected; however, pneumatic compression was used more frequently, whereas heparin was selected by only 2% of surgeons. This may reflect reluctance to use anticoagulants in the relatively new field of laparoscopic surgical procedures, where control of bleeding problems could be more difficult to achieve. On the other hand, in the clinical scenario of an elderly patient with a history of VTE, heparin was selected by 10% of respondents and combined physical-pharmacologic modalities by 65%. A similar approach was preferred for high-risk colon surgical procedures. As could be expected, very few surgeons would adopt prophylaxis for local excision of benign breast lumps. For inguinal hernia repair with patients under epidural anesthesia, 50% of surgeons selected physical modalities, and only 2% selected heparin. These results indicate that when confronted with specific clinical situations, North American surgeons are very selective in their use of heparin, restricting its use, most of the time, to patients at very high risk in combination with physical methods.

For patients at moderate risk most surgeons preferred physical modalities. Nevertheless, we

should keep in mind that these data reflect the surgeons' attitudes. In other words the real daily current surgical practice could be significantly different from these theoretic estimates. In a previous study conducted at our hospital, we found that the percentage of implementation of prophylaxis was 76% in patients at high risk, 43% in patients at moderate risk, and 10% in patients at low risk.¹¹ Those results coincided with this survey's in a very low use of heparin, with only 5% of patients who were undergoing a surgical procedure receiving this agent, alone or in combination with other modalities.

In summary, and despite the limitations of this kind of survey, the results of this study indicate that North American surgeons who responded to this survey are well aware of the problem of VTE, because more surgeons are currently using some form of prophylaxis for patients at high risk to prevent this dreadful complication. The approach to prophylaxis has been significantly modified in the last 10 years by a higher implementation of physical methods, especially intermittent pneumatic compression, whereas low-dose heparin remains the preferred pharmacologic agent. A surprising number of patients received aspirin, given the negative literature available and lack of endorsement by the National Institutes of Health. Despite convincing literature the concept of age as a risk factor was not generally accepted in North America, Australia, or New Zealand. Prophylaxis was not widely used in these older individuals unless other risk factors were present. In general, responding surgeons achieved a good assessment of the potential thrombotic risk of their patients, and, as a result, prophylaxis is being tailored more frequently to the patient's risk level.

Finally, we realize that this type of survey is associated with a variety of problems, and the information obtained must be interpreted with caution. Nevertheless we believe that this type of analysis is important and has its place, because it permits comparisons of U.S. results with those obtained in other practice settings and different parts of the world.

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APPENDIX: THROMBOSIS PROPHYLAXIS SURVEY

IN GENERAL HOW WOULD YOU RATE THE PROBLEM OF VENOUS THROMBOSIS (VTE) AMONG SURGICAL PATIENTS?

Very Serious	Somewhat Serious	Not Serious
1	2	3

APART FROM EARLY AMBULATION, DO YOU UTILIZE SPECIAL PROPHYLACTIC MEASURES TO PREVENT POSTOPERATIVE VTE?

1. Yes
 2. No

3. IF NOT, FOR WHAT REASON(S)? (Check all that apply)

1. Incidence of VTE is low in my experience
 2. Available modalities of prophylaxis are not fully effective
 3. Risk of complications secondary to the use of anticoagulants
 4. Available modalities too costly
 5. Other (specify _____)

4. WHICH METHOD(S) ARE YOU CURRENTLY IMPLEMENTING? (Check all that apply)

1. Early ambulation
 2. Elastic stockings
 3. Short-leg pneumatic compression
 4. Long-leg pneumatic compression
 5. Foot pneumatic compression
 6. Low-dose oral anticoagulants
 7. Dextran 40
 8. Dextran 70
 9. Fixed doses of low-dose heparin
 10. Adjusted doses of low-dose heparin
 11. Aspirin
 12. Combination of physical and pharmacologic methods
 13. Other (specify _____)

5. WHEN DO YOU USE PHARMACOLOGIC METHODS? (Check all that apply)

1. Preoperatively
 2. Intraoperatively
 3. Postoperatively
 4. Other (specify _____)

WHEN DO YOU USE PHYSICAL METHODS? (Check all that apply)

1. Preoperatively
 2. Intraoperatively
 3. Postoperatively
 4. Other (specify _____)
 5. do not use physical methods

7. PLEASE ASSESS THE CHARACTERISTICS ASSOCIATED WITH EACH PROPHYLACTIC METHOD BY CIRCLING THE APPROPRIATE NUMBER. (WHERE 1 IS LOW AND 5 IS HIGH).

	Low	High	1	2	3	4	5
Safety							
1. Safety							
2. Safety							
3. Safety							
4. Safety							
5. Safety							
Efficacy							
1. Efficacy							
2. Efficacy							
3. Efficacy							
4. Efficacy							
5. Efficacy							
Simplicity							
1. Simplicity							
2. Simplicity							
3. Simplicity							
4. Simplicity							
5. Simplicity							
Cost effectiveness							
1. Cost effectiveness							
2. Cost effectiveness							
3. Cost effectiveness							
4. Cost effectiveness							
5. Cost effectiveness							

Heparin
 Coumadin
 Elastic stockings
 Pneumatic devices

Heparin
 Coumadin
 Elastic stockings
 Pneumatic devices

Heparin
 Coumadin
 Elastic stockings
 Pneumatic devices

Heparin
 Coumadin
 Elastic stockings
 Pneumatic devices

8. HAVE YOU MODIFIED YOUR APPROACH TO PROPHYLAXIS IN THE LAST TEN YEARS? 1. Yes

NO

9. IF YOU HAVE, FOR WHAT REASONS? (Check all that apply)

1. Improved pharmacologic agents
 2. Improved physical methods
 3. Increased awareness
 4. Concerns about liability issues

10. IF YOU WERE CONSIDERING WHETHER OR NOT TO UTILIZE VTE PROPHYLAXIS FOR A PATIENT, WHICH THREE FACTORS ARE MOST CRITICAL IN YOUR EXPERIENCE?

- Advanced age
- Length of surgical procedure
- History of previous thrombosis
- Pelvic surgery
- Cancer
- Varicose veins
- Obesity
- Anticipated immobilization
- Blood disorder (hypercoagulability)
- Other (specify _____)

11. FOLLOWING IS A LIST OF THE MODALITIES OF VTE PROPHYLAXIS CURRENTLY AVAILABLE IN THIS COUNTRY. PLEASE INDICATE WHICH ONE(S) YOU WOULD RECOMMEND IN THE CLINICAL SITUATIONS THAT ARE DESCRIBED ON THE OPPOSITE PAGE. (*Forexample, if in the first case you decided to recommend elastic stockings plus low-dose heparin, you should indicate B and D.*)

VTE PROPHYLACTIC MODALITIES A No prophylaxis necessary B Elastic stockings C Sequential Compression Device D Low-dose heparin E Coumadin F Dextran G Aspirin

CLINICAL SITUATIONS

- _ 55-year-old woman undergoing elective cholecystectomy through conventional laparotomy, without additional risk factors.
- _ 75-year-old man scheduled for colon resection for rectal carcinoma, with a history of congestive heart failure.
- _ 24-year-old woman who needs excisional biopsy for a breast fibroadenoma and without additional risk factors.
- _ 47-year-old woman scheduled for laparoscopic cholecystectomy without additional risk factors.
- _ 78-year-old woman with acute cholecystitis undergoing laparoscopic cholecystectomy. The patient has severe varicose veins and a history of deep vein thrombosis on two prior occasions.
- _ 60-year-old man scheduled for repair of indirect inguinal hernia under epidural anesthesia and without additional risk factors.
- _ 54-year-old obese woman presenting with acute abdominal pain suggestive of acute appendicitis and without additional risk factors.

12. IN YOUR PRACTICE, WHAT IS THE FIRST TEST YOU ORDER FOR SUSPECTED DVT?
- D Hand-held doppler
 - D B-mode ultrasonography (Duplex)
 - D Outflow plethysmography
 - D Venogram

D Other
(please specify)

13. PLEASE INDICATE WHICH GENERAL CATEGORIES OF SURGICAL PROCEDURES ARE MOST COMMON IN YOUR PRACTICE. (Check 3/1 that apply)
- G General abdominal surgery D Hernia repair D Colo-rectal surgery Q Laparoscopic surgery D Other _____ (please specify)
14. WHAT IS THE CAPACITY OF THE HOSPITAL AT WHICH YOU CURRENTLY PRACTICE?
- D Fewer than 200 beds D 200-500 beds D More than 500
15. IS THIS HOSPITAL A TEACHING HOSPITAL OR AFFILIATED WITH A MEDICAL SCHOOL?
- D Yes D No
16. DO YOU HAVE AN ACADEMIC APPOINTMENT?
- D Yes D No
17. HOW MANY YEARS HAVE YOU BEEN IN PRACTICE?
- D 1-10 years D 11-20 years D 21-30 years Q More than 30 years
18. WHAT IS THE POPULATION OF THE CITY IN WHICH YOU PRACTICE? (If you practice in a suburb of a large city, please refer to the larger metropolitan area.)
- D 0-20,000 D 20,000-100,000 D 100,000-500,000 D 500,000-1,000,000 D Over 1,000,000