

Original article

Predictive factors of thromboembolic events in patients undergoing Roux-en-Y gastric bypass

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Abstract

Background: Obesity is a major risk factor for postoperative deep venous thrombosis (DVT) and pulmonary embolism (PE). Identifying those patients at the greatest risk for DVT/PE is essential to prevent thromboembolic events among patients undergoing Roux-en-Y gastric bypass (RYGB) for clinically significant obesity. This aim of the study is to identify factors associated with an increased likelihood of developing DVT/PE after RYGB.

Methods: Prospectively collected data from 660 consecutive patients who underwent RYGB were reviewed. Patients received perioperative prophylaxis with low molecular weight heparin and sequential compression devices. Diagnosis was based on clinical, radiologic, and/or necropsy findings. Patients with and without postoperative DVT/PE were compared using χ^2 and multivariate logistic regression analysis.

Results: A total of 23 patients (3.5%) developed postoperative DVT/PE. Age > 50 years ($P = .04$), previous DVT/PE ($P = .02$), history of smoking ($P < .01$), revisional operation ($P = .03$), open RYGB ($P = .02$), and anastomotic leak ($P < .0001$) significantly increased the likelihood of developing DVT/PE. On the other hand, gender, body mass index > 50 kg/m² and history of sleep apnea, hypertension, diabetes, or myocardial infarction did not increase the likelihood of DVT/PE. Multivariate analysis revealed that age > 50 years ($P = .04$), postoperative anastomotic leak ($P < .001$), smoking ($P < .01$), and previous DVT/PE ($P < .001$) increased the likelihood of postoperative DVT/PE.

Conclusions: Age > 50 years, anastomotic leak, smoking, and history of DVT/PE all increase the likelihood of postoperative thromboembolic events in patients undergoing RYGB. Further preoperative screening and/or postoperative prophylaxis may be needed in this subset of high-risk patients. © 2006 American Society for Bariatric Surgery. All rights reserved.

Keywords:

Obesity; Roux-en-Y gastric bypass; Pulmonary embolism; Deep venous thrombosis for venous thromboembolism prophylaxis; Complications

Pulmonary embolism (PE) accounts for approximately 150,000 deaths per year in the United States and is considered the most common preventable cause of in-hospital deaths [1]. Although once considered controversial, recent evidence now implicates obesity as a risk factor in the development of thromboembolic events [1,2]. Moreover,

clinically significant obesity, defined as body mass index (BMI) > 40 kg/m², is an independent risk factor for postoperative sudden death from acute PE [3].

Mortality after bariatric surgery has been reported in up to 2% of patients; PE is probably the most common cause of unexpected postoperative death in these patients [4–7]. Consequently, a recently published survey found that > 95% of bariatric surgeons provide routine prophylaxis for venous thromboembolism and 38% use a combination of two or more methods simultaneously [8]. Despite adequate prophylaxis, however, postoperative deep venous thrombo-

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sis (DVT) and PE occur in 2% to 4% of patients undergoing Roux-en-Y gastric bypass (RYGB) [5–8]. Although thromboembolic events are relatively uncommon, mortality rates between 25% and 67% have been reported in patients who develop PE [2,4–7,9]. An estimated one-half of all bariatric surgeons have had at least one mortality due to postoperative PE [8].

Risk factors for thromboembolic events after general surgery are well described in the literature. The Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED) study showed that patients who developed postoperative PE are more likely to have at least one major risk factor [10,11].

The aim of the present study was to identify possible predictive factors associated with increased risk of developing DVT/PE in patients with clinically significant obesity who underwent RYGB for weight loss. We sought to identify a subgroup of patients at higher risk for DVT/PE who may require additional diagnostic or prophylactic measures.

Methods

This study was approved by the Institutional Review Board of the University of South Florida College of Medicine. We reviewed prospectively collected data from 660 consecutive patients who underwent RYGB for the treatment of clinically significant obesity between June 1998 and December 2004. All patients fulfilled the criteria established by the National Institutes of Health, including a BMI ≥ 40 kg/m² or ≥ 35 kg/m² with life-threatening obesity-related comorbid conditions. The patients were required to undergo evaluation by our interdisciplinary obesity treatment group composed of a bariatrician, a psychologist, a nutritionist, a pulmonologist, and a surgeon.

All patients received perioperative prophylaxis for venous thromboembolism consisting of subcutaneous heparin injections and sequential compression devices on call to the operating room. Patients with BMI < 50 kg/m² received 40-mg subcutaneous injections of low molecular weight heparin (enoxaparin) daily until discharge from the hospital. Patients with BMI ≥ 50 kg/m² received 30 mg of enoxaparin twice daily. Patients with BMI ≥ 60 kg/m² or with relative immobility were discharged home on extended prophylaxis for 10 to 14 days. Prophylactic inferior vena cava (IVC) filters were reserved for patients with a previous history of DVT, PE, or hypercoagulability disease.

All patients with postoperative calf pain, Homan's sign, swelling, unexplained fever, or erythema underwent duplex ultrasound evaluation of both lower extremities. Patients with clinical signs suggestive of PE, including tachypnea, tachycardia, chest pain, dyspnea, and hypoxemia, were evaluated by chest radiography and arterial blood gas analysis; patients weighting < 350 lb (the upper weight limit for computed tomography [CT] scan) underwent chest CT-angiography scan; otherwise, a ventilation/perfusion (VQ) scan was done.

Table 1

Incidence of deep venous thrombosis (DVT) or pulmonary embolism (PE) in 660 patients undergoing Roux-en-Y gastric bypass

Diagnosis	n (%)
DVT	9 (1.4%)
DVT + PE	7 (1.1%)
FE	6 (0.9%)
Inferior vena cava thrombosis	1 (0.2%)
Total	23 (3.5%)

Diagnosis of DVT/PE was based on clinical, radiologic, and/or necropsy findings. Patients were divided into two groups: group A, those without postoperative thromboembolic events, and group B, those who developed DVT/PE postoperatively. Patient characteristics, past medical history, and operative data were compared between the two groups.

Statistical analysis

Continuous parametric data were compared using the two-tailed Student *t*-test. Continuous nonparametric data were compared using the Mann-Whitney *U*-test. Categorical data were compared using either the two-tailed χ^2 test or Fisher's exact test, as appropriate. Multivariate-adjusted logistic regression analysis was used to assess the independent relationships between patient characteristics, medical history, and operative data and the risk for developing postoperative DVT/PE.

Results

A total of 660 patients underwent either open or laparoscopic RYGB for weight loss between July 1998 and December 2004 at our institution. Of these, 23 patients (3.5%) developed postoperative DVT, PE, or both and constituted group B (Table 1); the remainder 637 patients were classified as group A.

Location of DVT

The most common thromboembolic event was DVT without PE. Of the 16 patients who developed postoperative DVT, 12 had DVT in the lower extremities, 2 developed a thrombus in the jugular vein related to an indwelling venous catheter, and 2 developed upper extremity DVT manifested as limb swelling.

Diagnosis of DVT/PE

All cases of DVT were diagnosed by duplex ultrasound examination of the lower or upper extremities. Cases of PE were diagnosed by chest CT-angiography scan in seven patients (54%), by VQ scan in three patients (23%), and at necropsy in one patient (23%). Two patients died at home 7 days postoperatively in a clinical setting typical of PE; both had received an extensive preoperative workup for coronary

atherosclerosis and had collapsed at home while ambulating to the bathroom after a period of prolonged bed rest. In both cases, a postmortem examination was not done, but the coroner listed PE as the cause of death. For the purposes of this study, we considered the likely cause of death as PE. The third patient who died at home within 1 week of RYGB had PE on necropsy.

Timing of DVT/PE

The timing of the thromboembolic event was a median of 5 days postoperatively (range, 0 to 21 days). One patient developed a right common femoral vein thrombosis 3 weeks postoperatively that presented as right-sided hemiparesis; a patent foramen ovale was found, and she recovered without incident after anticoagulation. As many as seven patients (30%) had already been discharged home when they developed the thromboembolic event. The three patients who died suddenly at home from PE were 5 to 8 days post-RYGB.

One patient who underwent laparoscopic RYGB developed respiratory difficulty in the postanesthesia care unit. Because of hypoxemia and shunting, a CT-angiography scan was done, which confirmed multiple bilateral PE events intraoperatively. The patient required prolonged mechanical ventilation for 7 days and recovered uneventfully. She later reported that she developed dyspnea 2 weeks preoperatively but did not alert us out of fear that we would cancel her procedure. Another patient developed a large thrombus that apparently originated from the left iliac vein and subsequently extended to the IVC (Fig. 1) 3 weeks postoperatively. Subsequent hematologic studies revealed that these two patients had a mutation for Factor V Leiden.

Univariate analysis of risk factors

Compared with the patients who did not develop DVT/PE (group A), the patients who developed DVT/PE (group B) were more likely to have the following characteristics: age > 50 years, previous DVT/PE, history of smoking, revisional operation, open RYGB, and postoperative anastomotic leak (Table 2). There was a trend toward more patients with mechanical arthropathy in group B; however, the difference between the groups did not reach statistical significance ($P = .08$). Male gender, BMI > 50 kg/m², obstructive sleep apnea, hypertension, diabetes, and history of previous myocardial infarction were not associated with an increased likelihood of DVT/PE.

Multivariate analysis

Using multivariate analysis, we found that age > 50 years, history of smoking, and/or previous DVT/PE and postoperative anastomotic leak were associated with an increased likelihood of developing postoperative thromboembolic events after RYGB (Table 3).

Discussion

PE is one of the most dreaded postoperative complications of bariatric surgery because of its high mortality and the antecedent challenges in prophylaxis, diagnosis, and treatment of venous thromboembolic events in patients with clinically significant obesity. The increased use of bariatric surgery has highlighted these challenges, especially in the current era of outcomes-driven practice and emphasis on patient safety. The impact of venous thromboembolism transcends bariatric surgery, as the obesity epidemic affects other surgical disciplines as well.

Inconsistency in the reported incidence of DVT/PE in bariatric patients is due to a multitude of factors. Most reports are not prospective studies and represent a single center's experience; moreover, data from large registries and meta-analyses lack specificity because of interinstitutional variations in clinical practice, data collection, and reporting.

Notwithstanding these shortcomings, we sought to analyze our data to report the incidence/prevalence of DVT/PE in a contemporary bariatric practice and, more important, to identify modifiable patient-related risk factors for DVT/PE. Multivariate analysis revealed that age > 50 years, history of DVT/PE, history of smoking, and postoperative anastomotic leak significantly increase the likelihood of DVT/PE. Open RYGB and revisional bariatric procedures (RYGB in our practice) were risk factors in univariate analysis but were not significant factors in multivariate analysis.

Because smoking poses a risk for postoperative complications, we instituted a strict policy of smoking cessation at the inception of our bariatric surgery program. We ask all patients who smoke to enroll in a smoking cessation program and to show proof of enrollment; however, this program is heavily dependent on patient compliance. Population-based studies have demonstrated that smoking is an independent risk factor for thromboembolism [12,13], underscoring the importance of smoking cessation before surgery in this high-risk group.

Although smoking appears to be the only modifiable risk factor, other risk factors, such as age > 50 years, pose special challenges. The mean age of our patient population is 44 ± 1 years, and 29% of our patients are ≥ 50 years old. We lack clear guidelines for prophylaxis in such high-risk patients; dosing guidelines and weight-based regimens are based on anecdotes, not on evidence-based medicine. There is considerable enthusiasm for weight-based prophylaxis in bariatric patients; however, most of the supporting studies are underpowered and lack diagnostic confirmation of thromboembolic events. Moreover, the use of prophylactic IVC filters is not supported by rigorous scientific data. Consequently, we cannot justify placing IVC filters in all patients; we recommend further studies in a larger number of patients to verify and confirm age as a risk factor before

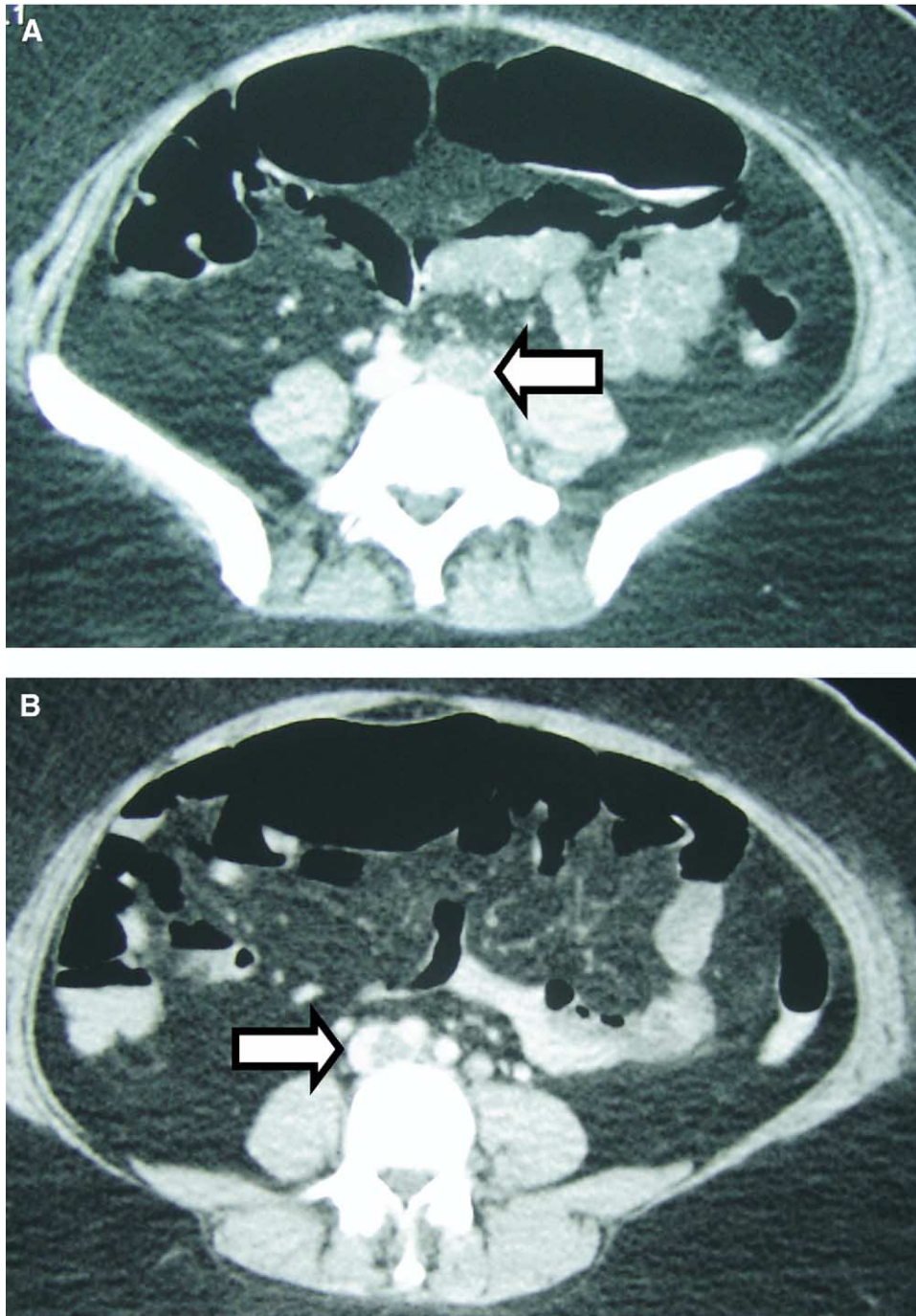


Fig. 1. A patient developed a thrombus that originated from the left iliac vein (A) and subsequently extended to the inferior vena cava (B). This patient was later diagnosed positive for Factor V Leiden mutation.

making a blanket recommendation for placing an IVC filter in all patients age > 50 years.

Our recommendation to insert IVC filters in all patients with a previous history of DVT/PE is justifiable by our findings in this study [14]. Equally justifiable is our current practice of inserting prophylactic filters in patients who develop anastomotic leak and require admission to the intensive care unit (as a marker of severity of the septic

response). In a separate study we found that 22% of patients who developed anastomotic leak will develop a DVT/PE, usually within the index hospitalization [15]. In addition, we recommend IVC filters in patients with known coagulation disorders, in patients with a history of DVT/PE, and in patients with relative immobility because of extreme weight or mechanical arthropathy.

Our data do not support routine screening for coagulopa-

thies, because the number of patients in this series is exceedingly small. If a coagulopathy is diagnosed preoperatively, then the patient should undergo additional prophylaxis, including IVC filter placement, because the combination of inherited disorders with other risk factors has a synergistic effect in increasing the risk of thromboembolic events.

We have adopted an aggressive regimen of prophylaxis with low molecular weight heparin, sequential compression devices, and early ambulation, in addition to ketorolac for pain control. The incidence of significant postoperative bleeding episodes necessitating transfusions is 5% in our cohort. The risk of bleeding is almost that of DVT/PE; nonetheless, in almost all cases bleeding was managed non-surgically, and it resulted in no mortality.

Theoretically, laparoscopic surgery results in less postoperative pain and thus should allow earlier ambulation in patients undergoing bariatric surgery. However, pneumoperitoneum has been proposed as a potential risk factor for developing DVT because of compression of the IVC and reduction of blood flow in the lower extremities [16]. In addition, a reverse-Trendelenburg position may promote venous stasis in the lower extremities. Nevertheless, bariatric surgery induces a hypercoagulable state in patients undergoing either open or laparoscopic RYGB and increases the risk for postoperative DVT [16,17]. Therefore, routine prophylaxis is recommended in patients undergoing RYGB regardless of the surgical approach.

Our data are in keeping with other reports in the literature. Age is a known risk factor for venous thromboembolism. The mean age of hospitalized patients with PE is 60 years; patients age > 75 are 10 times more likely to suffer a PE compared with those age < 40. History of previous

Table 2
Comparison of patient demographics, previous medical history, and operative data in patients without (group A) and with (group B) postoperative DVT and/or PE

	Group A (n = 637)	Group B (n = 23)	P
Demographics			
Male gender, n (%)	83 (13%)	3 (14%)	NS
Age >50 years, n (%)	185 (29%)	12 (52%)	.04
BMI >50 kg/m ² , n (%)	287 (45%)	11 (48%)	NS
Medical comorbidities			
Diabetes, n (%)	96 (15%)	5 (22%)	NS
Obstructive sleep apnea, n (%)	287 (45%)	12 (52%)	NS
Hypertension, n (%)	217 (34%)	9 (39%)	NS
Mechanical arthropathy, n (%)	268 (42%)	14 (60%)	NS
Coronary atherosclerosis, n (%)	25 (4%)	1 (4%)	NS
Smoking, n (%)	45 (7%)	5 (22%)	<.01
Previous DVT/PE, n (%)	13 (2%)	3 (14%)	.02
Operative data			
Open surgery, n (%)	331 (52%)	16 (68%)	.03
Revisional surgery, n (%)	57 (9%)	5 (22%)	.02
Anastomotic leak, n (%)	19 (3%)	7 (32%)	<.001

NS, not statistically significant.

Table 3
Multivariate-adjusted logistic regression analysis of the likelihood of developing postoperative DVT and/or PE in patients undergoing bariatric surgery

	P	Odds ratio*	95% Confidence Interval
Age >50 years	.04	2.8	1.02–7.5
Smoking	<.01	6.7	1.90–23.57
Previous DVT/PE	<.001	13.1	3.20–54.00
Anastomotic leak	<.001	25	8.52–75.91
Open RYGB	.16	2.59	0.68–9.89
Revisional surgery	.67	0.71	0.14–3.36

* Adjusted for all variables shown.

DVT/PE predisposes patients to recurrent disease; a 5% to 10% recurrence rate within the first year and a 2% to 3% rate thereafter have been reported [18].

Isolated postoperative PE without DVT is not uncommon after bariatric surgery. Miller et al. [19] reported that only one-third of their patients who developed a PE had a concomitantly demonstrable DVT. Therefore, it is essential to not exclude a PE in patients based on a negative finding of DVT on duplex ultrasonography.

That DVT/PE was found after discharge in 30% of patients is not an unexpected finding; Scholten et al. [20] reported that only two of the seven patients in their series developed thromboembolic events during the initial hospitalization, which is consistent with the necropsy findings of PE in patients 17 days after surgery reported by Melinek et al. [21]. Similar findings have been reported by Westling et al. [22]. Therefore, although PE is a major cause of death in the early postoperative period, it can occur after discharge and even long after surgery, when patients have regained full mobility.

According to autopsy findings in patients who underwent RYGB, the clinical presentation of PE is not always obvious; in one series, 30% of deaths were attributable to PE but there was evidence of recent and remote pulmonary infarction in 80% of the patients [21,23]. Sapala et al. [9] reported that the diagnosis was made at the time of the autopsy in 50% of the patients in their series. Hence a high index of suspicion for DVT/PE should always be maintained.

Conclusion

Patients age > 50 years with a history of previous DVT/PE, smoking, or anastomotic leak are at increased risk for developing postoperative DVT/PE. Further studies to delineate optimal prophylaxis are warranted.

References

- [1] Geerts WH, Heit JA, Clagett GP, et al. Prevention of venous thromboembolism. *Chest* 2001;119:132S–75S.

- [2] Shepherd MF, Rosborough TK, Schwartz ML. Heparin thromboprophylaxis in gastric bypass surgery. *Obes Surg* 2003;13:249–53.
- [3] Blaszyk H, Björnsson J. Factor V Leiden and morbid obesity in fatal postoperative pulmonary embolism. *Arch Surg* 2000;135:1410–3.
- [4] Schauer PR, Ikramuddin S, Gourash W, Ramanathan R, Luketich J. Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Ann Surg* 2000;232:515–29.
- [5] DeMaria EJ, Sugerman HJ, Kellum JM, Meador JG, Wolfe LG. Results of 281 consecutive total laparoscopic Roux-en-Y gastric bypasses to treat morbid obesity. *Ann Surg* 2002;235:640–7.
- [6] Livingston EH, Huerta S, Arthur D, Lee S, De Shields S, Heber D. Male gender is a predictor of morbidity and age a predictor of mortality for patients undergoing gastric bypass surgery. *Ann Surg* 2002;236:576–82.
- [7] Stoopan-Margain E, Fajardo R, Espana N, Gamino R, Gonzalez-Barranco J, Herrera MF. Laparoscopic Roux-en-Y gastric bypass for morbid obesity: results of our learning curve in 100 consecutive patients. *Obes Surg* 2004;14:201–5.
- [8] Wu EC, Barba CA. Current practices in the prophylaxis of venous thromboembolism in bariatric surgery. *Obes Surg* 2000;10:7–14.
- [9] Sapala JA, Wood MH, Schuhknecht MP, Sapala MA. Fatal pulmonary embolism after bariatric operations for morbid obesity: a 24-year retrospective analysis. *Obes Surg* 2003;13:819–25.
- [10] PIOPED Investigators. Value of the ventilation/perfusion scan in acute pulmonary embolism: results of the prospective investigation of pulmonary embolism diagnosis study (PIOPED). *JAMA* 1990;263:2753–9.
- [11] Anderson FA Jr, Wheeler HB. Venous thromboembolism: risk factors and prophylaxis. *Clin Chest Med* 1995;16:235–51.
- [12] Goldhaber SZ, Grodstein F, Stampfer MJ, et al. A prospective study of risk factors for pulmonary embolism in women. *JAMA* 1997;277:1933.
- [13] Hansson PO, Eriksson H, Welin L, Svardsudd K, Wilhelmsen L. Smoking and abdominal obesity: risk factors for venous thromboembolism among middle-aged men. The study of men born in 1913. *Arch Intern Med* 2001;161:1925–6.
- [14] Keeling W, Haines K, Stone P, Armstrong P, Murr MM, Shames M. Current indications for prophylactic IVC filters in patients undergoing surgery for clinically significant obesity. *Obes Surg* 2005;15:1009–12.
- [15] Gonzalez R, Nelson LG, Haines K, Gallagher SF, Murr MM. Added morbidity after anastomotic leaks in patients undergoing Roux-en-Y gastric bypass. *Surg Obes Relat Dis* 2005;1:281.
- [16] Sobolewski AP, Deshmurk RM, Brunson BL, et al. Venous hemodynamic changes during laparoscopic cholecystectomy. *Laparosc Surg* 1995;5:363–9.
- [17] Nguyen NT, Owings JT, Gosselin R, et al. Systemic coagulation and fibrinolysis after laparoscopic and open gastric bypass. *Arch Surg* 2001;136:909–16.
- [18] Prandoni P, Lensing AW, Coco A, et al. The long-term clinical course of acute deep vein thrombosis. *Ann Intern Med* 1996;125:1–7.
- [19] Miller MT, Rovito PF. An approach to venous thromboembolism prophylaxis in laparoscopic Roux-en-Y gastric bypass surgery. *Obes Surg* 2004;14:731–7.
- [20] Scholten DJ, Hoedema RM, Scholten SE. A comparison of two different prophylactic dose regimens of low molecular weight heparin in bariatric surgery. *Obes Surg* 2002;12:19–24.
- [21] Melinek J, Livingston E, Cortina G, Fishbein MC. Autopsy findings following gastric bypass surgery for morbid obesity. *Arch Pathol Lab Med* 2002;126:1091–5.
- [22] Westling A, Bergqvist D, Boström A, Karacagil S, Gustavsson S. Incidence of deep venous thrombosis in patients undergoing obesity surgery. *World J Surg* 2002;26:470–3.
- [23] Karwinski B, Svendsen E. Comparison of clinical and postmortem diagnosis of pulmonary embolism. *J Clin Pathol* 1989;42:135–9.

Editorial Comment

Venous thromboembolism (VTE) is a devastating complication of bariatric surgery. Pulmonary embolism (PE) is the leading cause of preventable death among bariatric surgical patients. The morbidly obese are at substantial risk of developing VTE in the postoperative period. The most common risk factors that augment the risk of VTE in bariatric surgery include general anesthesia, morbid obesity, venous stasis disease, obesity hypoventilation syndrome, and hypercoagulable disorders. Sapala et al. [1] identified five risk factors associated with fatal PE in bariatric surgery: body mass index (BMI) ≥ 60 kg/m², truncal obesity, obesity hypoventilation syndrome, ventricular septal defect, and subaortic stenosis. Sugerman et al. [2] found that patients with venous stasis were at higher risk of PE, anastomotic leak, hernia, and death.

This prospective study evaluated 660 bariatric surgical patients who underwent Roux-en-Y gastric bypass. All patients received a combination of mechanical and preoperative pharmacologic prophylaxis. Enoxaparin was administered postoperatively in a regimen determined by the patient's BMI. Extended prophylaxis was reserved for patients with "relative immobility" or a BMI of ≥ 60 kg/m². Inferior vena caval filters were inserted in the patients with prior VTE or hypercoagulable disorders.

The diagnosis of VTE was based on clinical, radiologic, or necropsy findings. The 23 patients with VTE (3.5%) were compared with the remaining 637 patients without VTE. The factors predictive of VTE by multivariate analysis were age ≥ 50 years, smoking, previous history of VTE, and anastomotic leak. Although the patients with a BMI > 60 kg/m² did not have a greater risk of VTE in this study, it is plausible that the extended prophylaxis regimen was responsible for reducing the incidence of VTE in this group.

The median time to presentation of VTE was 5 days, longer than the length of hospital stay for most bariatric surgical patients with an uncomplicated postoperative course. Most patients presented with VTE during their hospital stay; only 30% developed VTE at home. Whether the patients who presented with VTE in the hospital had a prolonged length of stay was not clear. The efficacy of extended prophylaxis in reducing VTE risk after bariatric surgery deserves additional evaluation.

The diagnosis of VTE on clinical grounds may be problematic. Obesity renders the identification of lower extremity edema difficult, and PE may elude clinical suspicion. Twenty-five percent of patients had upper extremity DVT, and one half of these were not associated with an indwelling venous cath-