Obesity Surgery (2020) 30:2274–2279
https://doi.org/10.1007/s11695-020-04468-6

ORIGINAL CONTRIBUTIONS

Association Between Surgeon Practice Knowledge and Venous Thromboembolism

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Published online: 16 February 2020

Abstract

Background The most common cause of mortality following bariatric surgery is venous thromboembolism. Our study aimed to (1) determine the practice patterns of venous thromboembolism (VTE) chemoprophylaxis among bariatric surgeons participating in a large statewide quality collaborative and (2) compare the results of surgeon self-reported chemoprophylaxis practices to actual practices from abstracted chart data.

Methods We administered a 13-question survey to 66 surgeons across a statewide collaborative aimed at revealing VTE practice patterns such as medication type, dosage, timing, duration, and level of trainee involvement (response rate 93%). We conducted on-site data audits to examine the charts of all patients that had developed VTE during the study period and 15 other randomly selected patient charts per site. We then evaluated both the ordered perioperative chemoprophylaxis and the actual administered chemoprophylaxis from nursing and electronic records.

Results There was 31% overall discordance between self-reported and abstracted chart data for pre-operative VTE dosing regimens. Among patients who had a VTE, 39% of administered chemoprophylaxis did not match surgeon responses. Conversely, among patients who did not have a VTE, only 29% were discordant ($p = 0.03$). In contrast, for post-operative VTE dosing, there was no significant difference in the rate of discordance in patients with and without a VTE (47% discordance vs 38%, $p = 0.0552$, respectively).

Conclusions Greater discordance between surgeon self-reported and actual perioperative VTE chemoprophylaxis is associated with significantly increased risk of VTE. Further understanding of the system characteristics associated with these practices may yield insights into how best to improve appropriate VTE chemoprophylaxis.

Keywords Venous thromboembolism · VTE · Bariatric surgery · Metabolic surgery · Health services research · VTE prophylaxis

Introduction

Venous thromboembolism (VTE) is the most common cause of mortality following bariatric surgery. Rates of deep vein thrombosis (DVT) and pulmonary embolism (PE) in the post-surgical setting may be as high as 5.4% and 6.4%, respectively [1–4]. Given these risks, VTE chemoprophylaxis is routinely recommended in the form of unfractionated heparin (UFH) or low molecular weight heparin (LMWH). The three most popular dosing regimens include giving UFH both pre-operatively and post-operatively (UFH/UFH), giving UFH pre-operatively and LMWH post-operatively (UFH/LMWH), and giving LMWH both pre-operatively and post-operatively (LMWH/LMWH). A large prospective study of a statewide registry recently found that rates of VTE were significantly lower when utilizing the LMWH/LMWH regimen (0.25%; $p < 0.001$) [5].

Despite these results, significant variation remains among bariatric surgeons regarding the type, dose, and duration of chemoprophylaxis. Several organizations, at both the state

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and national levels, have provided guidelines regarding optimal VTE chemoprophylaxis [6, 7]. However, there remains ambiguity regarding the specifics of dosing, especially as to which patients should be targeted for more aggressive chemoprophylaxis (i.e., extended post-discharge therapy). The lack of detailed recommendations, combined with a growing trend toward larger care teams and subsequent gap between attending surgeons and frontline providers, can lead to unexpected outcomes. We hypothesized that discordance between surgeon self-reported prescribing patterns and actual administered medication is associated with increased rates of VTE.

This study sought (1) to determine the practice patterns of VTE chemoprophylaxis among bariatric surgeons participating in a large statewide quality collaborative across forty sites, (2) to compare results of surgeon self-reported chemoprophylaxis practices to actual practices from abstracted chart data, and (3) to determine if there was a correlation between trainee participation in perioperative care and rate of discordance between the survey and chart data. A better understanding of the link between discordance and any potentially associated increased risk of VTE would be a valuable tool in investigating how best to improve VTE chemoprophylaxis and translate evidence-based guidelines into practice.

Methods

Study Population

Our study utilized clinical outcomes and survey data obtained through the Michigan Bariatric Surgery Collaborative (MBSC), a program which has been described in detail elsewhere [5]. Briefly, the MBSC, a payer-funded quality improvement organization, maintains a statewide, prospective, externally audited clinical outcomes registry. During the study period, the MBSC consisted of 66 practicing bariatric surgeons from 39 sites across the state and performed an average of 5883 surgeries annually.

Data Collection

We began by surveying the MBSC surgeons about their routine VTE chemoprophylaxis practices. The response rate was 93%. The survey consisted of 13 questions aimed at revealing VTE practice patterns such as medication type, dosage, timing, and duration (Appendix). We also included a question regarding the level of trainee involvement in perioperative care. Specifically, surgeons were queried as to whether they "never worked with residents" or if they "sometimes/always worked with residents."

Then, to assess the level of concordance between surgeon response and actual VTE prescribing patterns, we conducted an in-depth chart review. During our regularly conducted annual on-site data audits, we examined the charts of all patients that had developed VTE during the study period ranging from September 13, 2011, to April 13, 2016, and 15 other randomly selected patient charts across all 40 sites. The number 15 was selected in the context of data abstractor resource availability given the large number of practice sites. There were a total of 29,418 primary surgeries during the study period. Only revision surgeries were formally excluded from this study. We evaluated the actual administered VTE chemoprophylaxis from nursing and electronic inpatient records.

Primary Outcome

Our primary outcome was the occurrence of a VTE event, defined as a physician's diagnosis of a PE, DVT, or portal vein thrombosis (PVT) requiring treatment within 30 days following surgery. This data is abstracted by trained data abstractors within each surgical practice. Additional demographic and outcome data are abstracted and recorded in the registry [5]. Patient-level data included age, BMI, gender, OR time greater than 3 h, prior VTE, any history of smoking (recorded as a binary variable), and procedure type.

Statistical Analysis

We assessed the degree to which surgeon reported practices and chart abstracted medication administration practices were associated. We calculated percent concordance as the number of cases where chart-abstracted data and surgeon-reported results matched, divided by the total number of cases. Discordance was defined as number of cases where chart-abstracted data and surgeon-reported survey data differed, divided by total number of cases. For example, if a surgeon reported using 40 mg of LMWH pre-operatively and 40 mg of LMWH post-operatively, but the surgeon's patient received anything other than that combination, "discordance" was recorded.

We then evaluated VTE rates based on degree of concordance between self-reported and actual chemoprophylaxis regimens. We studied the association between practice concordance and VTE event using chi-square tests of association for both pre- and post-operative VTE prophylaxis. Further, we used chi-square tests to assess for associations between practice concordance and patient characteristics including age, BMI, gender, OR time greater than 3 h, history of prior VTE, smoking history, and procedure type. To evaluate the role of residents, we performed another set of chi-square tests: one for pre-operative VTE prophylaxis and a second for post-operative VTE prophylaxis. We used a significance level of $\alpha = 0.05$.

Results

Surgeon VTE Chemoprophylaxis Practices

The surgeon survey revealed that 82% of surgeons use the MBSC VTE risk calculator as a guide for prescribing practices. In the pre-operative setting, the most common chemoprophylaxis regimen was the administration of LMWH (86.2%). Of those using LMWH for pre-operative prophylaxis, the most common dose was 40 mg (66%) and the second most common was 30 mg (29%). Of the remaining surgeons, 6.2% stated they used 5000 IU subcutaneous heparin, 6.2% stated they did not utilize pre-operative pharmacologic prophylaxis, and the remaining 1.4% stated they utilized a different regimen. Post-operatively, we found that 97% of surgeons used LMWH for VTE prophylaxis. Specifically, the most common dosage was 40 mg once daily (37%) followed by 40 mg twice daily (27%) and 30 mg twice daily (25%). The remaining 11% of surgeons using LMWH as post-operative prophylaxis utilized a weight-based dosage. Only 3% of surgeons elected to give subcutaneous heparin as post-operative VTE prophylaxis.

Regarding the timing of the post-operative dose, we found that 55% of surgeons choose to administer VTE prophylaxis the day after surgery, while 42% administer their prophylaxis the night of surgery. Lastly, when post-discharge prophylaxis is indicated, the survey demonstrated that the most common regimen was LMWH 40 mg once daily (49%) followed by a weight-based prophylactic LMWH dose (20%). Also, we found that 54% of surgeons administer post-discharge prophylaxis for a duration of 8–14 days, 18% choose to administer their post-discharge prophylaxis for 1–7 days, 11% for 15–21 days, and 3% for 22–28 days.

Patient Characteristics

We evaluated several patient characteristics between the concordant and discordant groups in the pre-operative and post-operative settings. There were no significant differences in patient characteristics between these groups pre-operatively (Table 1). In the post-operative setting, procedure type was the only characteristic that was identified to be significantly different, with a higher percentage of adjustable gastric banding in the discordant group and higher percentages of gastric bypass and sleeve gastrectomy in the concordant group (Table 2).

Chemoprophylaxis Practice Discordance Rates and VTE

Per surgeon surveys, there is greater than 90% self-reported compliance with the MBSC VTE chemoprophylaxis guidelines. However, there is significant discordance between surgeon self-reported dosing practices and actual perioperative ordered and administered VTE chemoprophylaxis. The overall rate of VTE events during the study period was 0.4%. In the pre-operative setting, there were significant differences in the practice discordance rates between patients who developed a VTE and those who did not (39.0% vs 28.8%, respectively; $p = 0.03$). In contrast, in the post-operative setting, the practice discordance rates between patients who developed a VTE and those who did not were not significantly different (47.5% vs 37.9%, respectively; $p = 0.0552$) (Table 3).

To assess potential underlying causes of practice discordance, we evaluated the degree to which trainees were involved in perioperative care. We found an increased rate of discordance seen in the pre-operative setting among those surgeons who "sometimes or always work with residents" ($p < 0.0001$) (Table 4). In the post-operative setting, we found no significant difference in the rate of discordance based on resident involvement.

Discussion

Our study found that the majority of surgeons in a large, statewide bariatric surgery quality collaborative utilize an evidence-based approach to risk stratification and administration of VTE chemoprophylaxis. In the same cohort, there is also a high rate of practice discordance between surgeon-reported and actual, administered perioperative VTE chemoprophylaxis. Further, there is a significant association between practice discordance and increased risk of VTE. Finally, practice discordance rates are associated with increased resident involvement in pre-operative care.

Although there is no consensus on a specific dosing regimen for VTE chemoprophylaxis in bariatric surgery patients, it is well-established and accepted that some form of chemoprophylaxis should be used in the perioperative setting [7]. Our data supports the results of both Pryor et al. and the American Society for Metabolic and Bariatric Surgery (ASMBS) such that nearly all (94%) of our respondents agreed that some form of pre-operative chemoprophylaxis was appropriate for patients undergoing bariatric surgery [8, 9]. More specifically, the updated 2013 position statement from the ASMBS states that, for pre-operative prophylaxis, it is "reasonable" to use LMWH 30–40 mg every 12 h or UFH 5000 IU subcutaneously every 8 h [7]. Our data aligned with this recommendation, with 88% of the surgeons responding that they used 30–40 mg of LMWH. The variability demonstrated by the other 12% of surgeons who belong to the same quality collaborative, however, highlights the heterogeneity in practice patterns and underscores the lack of class I evidence to guide decision making. This division between recommended VTE prophylaxis and the actual practice

Table 1 Pre-operative patient characteristics grouped by presence of discordance

Variable	Discordance (193) mean ± SD or % (*N*)	Concordance (433) mean ± SD or % (*N*)	*p* value
Age	46.3 ± 11	46.5 ± 11	0.8953
BMI	47.8 ± 9	48.5 ± 9	0.3388
Male gender	20.7 (40)	22.6 (98)	0.5950
OR time > 3 h	4.2 (8)	5.8 (25)	0.4072
Prior VTE	6.7 (13)	7.6 (33)	0.7072
Smoking history	39.6 (76)	46.5 (201)	0.1071
Procedure			
Sleeve	77.6 (149)	74.1 (321)	
RYGB	20.8 (40)	20.1 (87)	
Band	1.6 (3)	5.6 (23)	0.1310

patterns has been well-documented in the literature, specifically by the ENDORSE trial which showed that of surgical patients at risk of VTE, only 58.5% received appropriate VTE prophylaxis for their condition [10]. In fact, to date, there has been no prospective, randomized clinical trial to determine optimal VTE prophylaxis dosing or timing [11].

While additional studies focused on developing optimal practice guidelines are still needed, there is data to suggest when surgeons deviate from current practice recommendations, rates of VTE increase. For example, Lau et al. found that when the percent of patients who were prescribed "appropriate" (as determined by adherence to a clinical decision support tool developed at Johns Hopkins Hospital), VTE prophylaxis improved from 89.4 to 95.4%, VTE rate dropped, and preventable VTEs were eliminated completely [12]. The MBSC has developed a similar decision support tool in order to assist providers in choosing appropriate VTE prophylaxis; however, adherence to the recommendations provided by the MBSC clinical decision support tool is only 82%. Based on the results from Lau and colleagues, this presents a potential area for practice improvement.

In assessing other potential areas for improvement, it is important to consider environmental factors that may contribute to increased rates of VTE seen in the presence of discordance. For example, we found an increased rate of discordance in pre-operative dosing seen with MBSC surgeons who "sometimes or always work with residents" as compared with those surgeons who have no resident involvement ($p < 0.0001$). Optimizing team communication and the use of established perioperative VTE protocols may help reduce the risk of VTE in bariatric surgery patients. Several studies have described the use of individualized feedback for residents to optimize performance and adherence to established guidelines [12, 13]. Specifically, Lau et al. found that the implementation of a "scorecard plus individualized resident coaching" method resulted in the percent of residents prescribing appropriate prophylaxis for every patient increasing from 45 to 78% [12]. Therefore, building a component of VTE prophylaxis feedback into an institution's existing individualized resident feedback network may prove valuable in reducing VTE rates.

Table 2 Post-operative patient characteristics grouped by presence of discordance and VTE incidence

Variable	Discordance (248) mean ± SD or % (*N*)	Concordance (377) mean ± SD or % (*N*)	*p* value	VTE (118) mean ± SD or % (*N*)	No VTE (507) mean ± SD or % (*N*)	*p* value
Age	45.9 ± 12	46.8 ± 11	0.3063	47.8 ± 11	46.1 ± 11	0.1518
BMI	48.2 ± 8	48.4 ± 9	0.7509	49.3 ± 9	48.1 ± 11	0.1672
Male gender	21.8 (54)	22.3 (84)	0.8812	27.1 (32)	20.1 (106)	0.1429
OR time > 3 h	5.7 (14)	5.0 (19)	0.7406	11.0 (13)	3.9 (20)	0.0020*
Prior VTE	7.3 (18)	7.4 (28)	0.9369	13.6 (16)	5.9 (30)	0.0042*
Smoking history	41.1 (102)	46.5 (175)	0.1829	42.4 (50)	44.9 (227)	0.6241
Procedure						
Sleeve	72.6 (180)	76.9 (290)		61.9 (73)	78.3 (379)	
RYGB	19.0 (47)	21.2 (80)		33.1 (39)	17.4 (88)	
Band	8.1 (20)	1.59 (6)	0.0012*	5.1 (6)	3.9 (20)	0.0012*

They are all <0.05

Table 3 Comparison of VTE versus no VTE differentiated by discordance

Pre-operative discordance				
Overall (192)	VTE (46)	No VTE (146)	X^2	*p* value
30.7%	39.0%	28.8%	4.667	0.0308*
Post-operative discordance				
Overall (248)	VTE (56)	No VTE (192)	X^2	*p* value
39.7%	47.5%	37.9%	3.676	0.0552

They are all <0.05

There were several limitations to this study. First, our study population is limited to a single state and surgeons participating in a regional quality collaborative. Therefore, this may limit the generalizability of our results. However, our patient population is similar to other institutions across the country [14]. Second, discordance data was presented as a binary variable (i.e., concordant vs discordant). The results could benefit from increased granularity regarding the specific type of discordant event. For example, the scenario where a patient receives UFH instead of the prescribed LMWH is different than one where the patient receives nothing. Both, however, are recorded as discordant. Third, data on resident involvement was recorded as "never" versus "sometimes/always works with residents." As a result of examining this as a binary variable, we are unable to analyze the potential effect of incremental resident involvement. Fourth, smoking history was recorded as a binary variable, including any history of smoking. Recording the variable as such prevents any stratification by pack-year quantity and does not allow the authors to differentiate between current and former smokers. Finally, when examining the link between procedure type and practice discordance rates in the postoperative setting, we noted a higher rate of discordance for adjustable gastric banding. Since adjustable gastric banding has the lowest rate of VTE among the included procedures, there was potential for the discordant group to be biased and mask the full negative effects of discordance on VTE outcomes.

This study's findings are of particular importance to practicing bariatric surgeons given the significant morbidity and mortality associated with VTE. Bariatric surgery has been on the forefront of surgical safety with drastic improvements over the last 20 years [15]. With an ongoing obesity epidemic, the number of bariatric procedures performed is expected to increase, and the focus on safety must not be lost. Studies such as this aim to provide a better understanding of the macro- and micro-system characteristics of VTE prevention strategies and to yield insights into how best to improve appropriate VTE chemoprophylaxis. On the surface, this study implies that by ensuring bariatric surgery patients receive the VTE chemoprophylaxis protocol intended by the surgeons' routine practice pattern, VTE events might be reduced. However, the practice discordance rates may also be a surrogate for other problems in the perioperative team approach to bariatric surgery. Additionally, a work by Najjar and colleagues has demonstrated that a systematic post-discharge VTE prophylaxis pathway was associated with significantly fewer VTE events [16]. A more focused evaluation of practices with high rates of discordance, particularly regarding sites that implemented a standardized bariatric pathway in the interim, may yield further actionable data.

While this study was not able to determine an optimal VTE prophylaxis, our ongoing work focuses on identifying more precise and patient-specific dosing regimens. We hope to introduce a more definitive chemoprophylaxis guideline for prevention of VTE in bariatric surgery patients in the near future.

Table 4 The role of resident involvement in rate of discordance

Pre-operative dosing				
	Discordance *N* (%)	**Concordance *N* (%)**	**Total**	***p* value**
Never works with residents	120 (25.7)	347 (74.3)	467	< 0.0001
Sometimes/always works with residents	71 (68.9)	32 (31.1)	103	
Total	191	379	570	
Frequency missing = 55				
Post-operative dosing				
	Discordance	**Concordance**	**Total**	***p* value**
Never works with residents	191 (40.9)	276 (59.1)	467	0.3781
Sometimes/always works with residents	47 (45.6)	56 (54.4)	103	
Total	238	332	570	
Frequency missing = 55				

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest Dr. Ghaferi is supported through grants from the Agency for Healthcare Research and Quality (Grant Nos.: 5K08HS02362 and P30HS024403) and a Patient Centered Outcomes Research Institute Award (CE-1304-6596). Dr. Ghaferi receives salary support from Blue Cross Blue Shield of Michigan as the Director of the Michigan Bariatric Surgery Collaborative.

Drs. Finks and Varban receive salary support from Blue Cross Blue Shield of Michigan in association with their participation in the Michigan Bariatric Surgery Collaborative.

The remaining authors have no conflicts of interest nor sources of outside funding to declare.

Appendix. Survey question sent to participating MBSC surgeons

- Q1: Do you use MBSC's Risk Calculator for VTE – (Y/N)
- Q2: Do you follow the MBSC guidelines for VTE prophylaxis – (Y/N)
- Q3: Do you use sequential compression devices (SCDs) for your patients – (Y/N)
- Q4: What do you give patients for VTE prophylaxis PRE-operatively? (LMWH, 5000U Sub-Q Heparin, No Pharmacologic Prophylaxis, Other)
- Q5: What dose of LMWH do you give PRE-operatively? – (30mg, 40mg, weight-based prophylactic dose)
- Q6: What do you give patients for VTE prophylaxis POST-operatively? – (LMWH Injection, Sub-Q Heparin)
- Q7: What dose of SubQ heparin do you use POST-operatively – (500U q8hrs, 500U q12hrs)
- Q8: What dose of LMWH do you use POST-operatively – (30mg once daily, 30mg twice daily, 40mg once daily, 40mg twice daily, weight-based prophylactic LMWH and if so please specify)
- Q9: When is the first POST-operative dose of VTE prophylaxis given? – (day after surgery, night of surgery, other please specify)
- Q10: Do you give POST-DISCHARGE VTE prophylaxis? – (Yes, always; Yes, if the MBSC guidelines for risk recommend it; Yes, but I don't use the MBSC risk parameters; No)
- Q11: What do you give patients for VTE prophylaxis POST-DISCHARGE? – (LMWH 30mg twice daily, LMWH 40mg once daily, LMWH 40mg twice daily, LMWH Weight Based, Other)
- Q12: What duration of days do you give VTE prophylaxis POST-DISCHARGE? – (1–7, 8–14, 15–21, 22–28, 29–35)
- Q13: Do you work with residents in your daily practice? – (Never, Sometimes/Always)

References

1. Quebbemann B, Akhondzadeh M, Dallal R. Continuous intravenous heparin infusion prevents peri-operative thromboembolic events in bariatric surgery patients. Obes Surg. 2005;15(9):1221–4.
2. 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(1):19–24.
3. Escalante-Tattersfield T, Tucker O, Fajnwaks P, et al. Incidence of deep vein thrombosis in morbidly obese patients undergoing laparoscopic Roux-en-Y gastric bypass. Surg Obes Relat Dis Off J Am Soc Bariatr Surg. 2008;4(2):126–30.
4. Kardys CM et al. Safety and efficacy of intravascular ultrasound-guided inferior vena cava filter in super obese bariatric patients. Surg Obes Relat Dis Off J Am Soc Bariatr Surg. 2008;4(1):50–4.
5. Birkmeyer NJO et al. Comparative effectiveness of unfractionated and low-molecular-weight heparin for prevention of venous thromboembolism following bariatric surgery. Arch Surg. 2012;147(11):994–8.
6. Finks JF et al. Predicting risk for venous thromboembolism with bariatric surgery: results from the Michigan Bariatric Surgery Collaborative. Ann Surg. 2012;255(6):1100–4.
7. ASMBS updated position statement on prophylactic measures to reduce the risk of venous thromboembolism in bariatric surgery patients- ClinicalKey. [Online]. Available: https://www.clinicalkey.com/#!/content/playContent/1-s2.0-S1550728913000993. [Accessed: 26-Oct-2018].
8. Pryor HI, Singleton A, Lin E, et al. Practice patterns in high-risk bariatric venous thromboembolism prophylaxis. Surg Endosc. 2012;27(3):843–8.
9. Prophylactic measures to reduce the risk of venous thromboembolism in bariatric surgery patients, American Society for Metabolic and Bariatric Surgery. [Online]. Available: https://asmbs.org/resources/prophylactic-measures-to-reduce-the-risk-of-venous-thromboembolism-in-bariatric-surgery-patients. [Accessed: 01-Sep-2016].
10. Cohen AT et al. Venous thromboembolism risk and prophylaxis in the acute hospital care setting (ENDORSE study): a multinational cross-sectional study. Lancet. 2008;371(9610):387–94.
11. Bartlett MA, Mauck KF, Daniels PR. Prevention of venous thromboembolism in patients undergoing bariatric surgery. Vasc Health Risk Manag. 2015;11:461–77.
12. Lau BDM et al. Individualized performance feedback to surgical residents improves appropriate venous thromboembolism prophylaxis prescription and reduces potentially preventable VTE: a prospective cohort study. Ann Surg. 264.6 (2016): 1181-1187.
13. Lau BD, Streiff MB, Pronovost PJ, et al. Attending physician performance measure scores and resident physicians' ordering practices. JAMA Surg. 2015;150(8):813–4.
14. T. L. A. of B. S. (LABS) Consortium. Perioperative safety in the longitudinal assessment of bariatric surgery. N Engl J Med. 2009;361(5):445–54.
15. Dogan K et al. Effectiveness and safety of sleeve gastrectomy, gastric bypass, and adjustable gastric banding in morbidly obese patients: a multicenter, retrospective, matched cohort study. Obes Surg. 2015;25(7):1110–8.
16. Chiang HA et al. Implementation of a perioperative venous thromboembolism prophylaxis program for patients undergoing radical cystectomy on an enhanced recovery after surgery protocol. Eur Urol Focus. 2018;