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The Effect of Blood Pressure on Hematoma Formation With Perioperative Lovenox in Excisional Body Contouring Surgery

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Background: Prophylactic use of low molecular weight heparin (LMWH) has been shown to be efficacious in decreasing thromboembolism. LMWHs are associated with increased rates of bleeding.

Objective: We reviewed perioperative blood pressure dynamics for patients who experienced hematomas while undergoing body contouring procedures while receiving enoxaparin (Lovenox), compared with similar patients who did not have development of a postoperative hematoma.

Methods: A retrospective chart review was performed examining 2 patient groups: 10 patients who experienced a hematoma after excisional body contouring surgery with perioperative Lovenox; and 10 similar patients with respect to sex, surgery type, massive weight loss status, and Lovenox administration, who did not have a hematoma. Preoperative and postoperative blood pressures were recorded, as were blood pressures during the last 2 hours of surgery. Mean arterial pressures (MAPs) were calculated for all time points, and mean intraoperative MAP was statistically compared with preoperative and postoperative MAP, for the two groups.

Results: The mean preoperative MAP for each group was the same (97.5 mm Hg vs 95.8 mm Hg; $P = .61$). The mean MAP for the last 2 hours of each case was significantly lower in the hematoma group (66.7 mm Hg vs 82.4 mm Hg; $P < .0001$), and a higher mean postoperative MAP reached significance in the hematoma group (96.3 mm Hg vs 88.5 mm Hg; $P = .05$). Both the difference between intraoperative and preoperative blood pressure (30.7 mm Hg vs 13.4 mm Hg; $P < .0001$) and between intraoperative and postoperative blood pressure (29.6 mm Hg vs 7.0 mm Hg; $P < .0001$) were increased in the hematoma group versus the non-hematoma group.

Conclusions: Many patients undergoing excisional body contouring surgery are at risk for VTE and may need perioperative chemoprophylaxis. However, maintaining a normal intraoperative blood pressure and vigilance in recognizing and treating postoperative hypertension may reduce the hematoma rate seen with perioperative administration of LMWH. (Aesthetic Surg J 2007;27;589–593)

Thromboembolic mechanical and chemoprophylaxis is necessary in many patients undergoing excisional body contouring to protect against the development of potentially life-threatening pulmonary embolus or deep venous thrombosis. The use of low molecular weight heparin (LMWH) is considered by some to be the standard in thromboembolic prevention in patients with massive weight loss and undergoing excisional body contouring.¹ The risk of pulmonary embolus may be small (0.1%- 0.3%) but can potentially be fatal.² The prevention of venous thromboembolism has become a very popular topic across all surgical specialties. In 2004 The American College of Chest Physicians underwent an extensive evidence-based review of antithrom-

botic and thrombolytic therapy and illustrated their recommendations for thromboembolic prevention with respect to numerous surgical specialties and procedures.²⁻⁵ Studies have demonstrated LMWH's ability to decrease the risk of thromboembolism, but with the potential to increase bleeding during and after surgery. This may lead to significant hematoma formation or postoperative blood transfusion.⁶⁻⁹

The incidence of hematoma formation varies depending on the surgical procedure. In abdominoplasty patients, hematoma development has been reported in the literature between 1% to 10%.^{1,10-15} Hematoma formation in surgical wounds has a negative effect on wound healing, recovery time, hospital stay, and overall

morbidity. Many plastic surgeons commonly agree that the benefit of chemoprophylaxis against thromboembolic development strongly outweighs the risk of perioperative bleeding, especially in the high-risk patient population. With the sizeable increase of patients with massive weight loss and undergoing excisional body contouring surgery, thromboembolism has become a popular topic among plastic surgeons. The optimal timing, dosage, and duration of LMWH in this patient population have yet to be determined and are currently being explored.

A significant correlation has been shown to exist between perioperative blood pressures and hematoma development.^{6,12,16-21} Some studies have attributed the cause of postoperative hematoma formation to the blood pressure fluctuations observed after anesthesia induced intraoperative hypotension, or because of exceedingly high postoperative pressures.^{7,18,22} Hypotensive anesthesia results in lower pressures within the small vessels and capillaries, which may result in a surgical field with less obvious hemorrhage. However, once the patients are allowed to return to their normal blood pressure state, these small vessels and capillaries may open, and bleeding may ensue, which may ultimately lead to postoperative hematoma formation.

With the increased awareness and prophylaxis against postoperative thromboembolism at our institution, we undertook a retrospective chart review of perioperative blood pressures and their relationship to hematomas in patients undergoing body contouring being treated with enoxaparin. Three hundred sixty consecutive excisional body contouring patients' charts from two senior surgeons (J.M.K., R.J.R.) at our institution were reviewed.

Materials and Methods

An Institutional Review Board–approved retrospective chart review was undertaken, and all available charts for patients who underwent excisional body contouring procedures from January 2003 to August 2006 at The University of Texas Southwestern Medical Center by two of the senior authors (J.M.K. and R.J.R.) were obtained. Pertinent data were recorded: age, sex, race, body mass index, medical and surgical history, medications, operation, operative time, intraoperative blood loss (mL), inpatient stay (days), drain output (mL), number of drains, thromboprophylaxis (enoxaparin, sequential compression devices, early ambulation), enoxaparin administration (timing of first dose, total dosage administered), and complications (hematoma, clinically significant bleeding requiring transfusion) were recorded. After the initial collection

of the data, the charts of the 10 patients who experienced a hematoma in the postoperative period were reviewed. Based on these patients' gender, massive weight loss status, surgical procedure, and timing of enoxaparin administration, an additional set of 10 patients who did not experience clinically significant hematomas, was reviewed. A *hematoma* was defined as any collection of blood requiring intervention and drainage. Collections of blood that did not require drainage were excluded from our results. Enoxaparin (Lovenox) was administered either before, during, or after surgery according to surgeon preference.

All charts were obtained to examine preoperative, intraoperative, and postoperative blood pressure. The preoperative blood pressure as documented by the anesthesiologist was recorded. The intraoperative blood pressure during the last 2 hours of the procedure was considered to be the time during the operation in which the surgeon was achieving hemostasis and wound closure. Postoperative blood pressures for the first hour in the postanesthesia care unit were recorded. Data from all 20 patients were incorporated into a Microsoft Excel database (Microsoft Corp., Redmond, WA).

Statistical analyses

Average preoperative, intraoperative, and postoperative mean arterial pressures (MAP = DBP +1/3PP) were calculated for patients with and without hematoma. Mean differences between preoperative and intraoperative pressures and intraoperative and postoperative MAP were calculated for both groups of patients. Means were then compared by use of a standard, two-tailed, unpaired *t* test.

Results

Of the 360 patients undergoing body contouring, 137 received perioperative enoxaparin chemoprophylaxis. There were a total of 11 (3.1%) hematomas among the 360 patients undergoing body contouring by the senior authors (Table 1). Ten of the 11 hematomas (90.9%) occurred in patients receiving LMWH. The hematoma-forming group was then evaluated for perioperative blood pressures against similar patients without hematoma in a similar fashion.

Preoperative MAPs were used as a reference point in comparing the two groups. The 10 patients in the hematoma-forming group had a preoperative MAP of 97.4 mm Hg and the 10 patients in the non-hematoma-forming group had a preoperative MAP of 95.8 mm Hg (Table 2).

Table 1. Hematoma rate with Lovenox use

	Hematoma		Total
	Yes	No	
Lovenox	10 (7.3%)	127 (92.7%)	137 (38.3%)
No- Lovenox	1 (0.5%)	220 (99.6%)	221 (61.7%)
Total	11 (3.1%)	347 (96.9%)	358

Fisher's exact test indicates a significantly higher ($P < .001$) occurrence of hematoma among those subjects receiving Lovenox.

Table 2. Mean preoperative MAP in patients receiving Lovenox

	N	Mean	Standard Deviation	P value
Patients with hematoma	10	97.4	7.32	.61
Patients without complication	10	95.8	6.56	

The t-test comparison of means indicates no difference in mean preoperative MAP between the two groups.

The mean intraoperative blood pressure taken during the last 2 hours of each case in the hematoma-forming group was 66.7 mm Hg whereas the mean intraoperative arterial blood pressure in the non-forming group was 82.4 mm Hg, P value $< .0001$ (Table 3). The postoperative MAPs for the hematoma and non-hematoma groups were 96.3 mm Hg and 88.5, respectively (Table 4). Both the difference between intraoperative and preoperative blood pressure (30.7 mm Hg vs 13.4 mm Hg; $P < .0001$) and between intraoperative and postoperative blood pressure (29.6 mm Hg vs 7.0 mm Hg; $P < .0001$) were significantly increased in the hematoma group versus the non-hematoma group (Figure 1).

Discussion

Hematoma formation can lead to postoperative complications such as infection, skin necrosis, wound dehiscence, and prolonged convalescence. As previously observed in other studies, hematoma formation is usually the result of a diffuse nonspecific bleeding rather than a discreet hemorrhage.^{12,13,16,19,20,22} The necessary use of anticoagulation prophylaxis leads to an increased potential for operative and postoperative bleeding.

Table 3. Mean intraoperative MAP

	N	Mean	Standard deviation	P value
Patients with hematoma	10	66.7	6.85	$< .0001$
Patients without complications	10	82.4	5.24	

The t-test comparison of means indicates significantly lower intraoperative MAP for patients who had hematoma.

Table 4. Mean postoperative MAP

	N	Mean	Standard deviation	P value
Patients with hematoma	10	96.3	7.67	$< .0001$
Patients without complications	10	88.5	8.71	

The t-test comparison of means indicates significantly higher postoperative MAP for patients who had hematoma.

Perioperative blood pressure control has been found to significantly decrease the risk of postoperative hematoma formation. Extensive reviews of patients undergoing rhytidectomy and breast reduction have continued to support the use of strict perioperative blood pressure control and its importance in prevention of postoperative hematoma formation.^{12,18-25}

In 1973 Straith et al²¹ showed on admission when blood pressures of patients undergoing rhytidectomy were in excess of 150/100 mm Hg, their incidence of hematoma was 2.6 times that of a patient with normal blood pressure. Berner et al²³ proposed that, to decrease the incidence of postoperative hematoma, one should medically protect against uncontrolled postoperative blood pressures. The postoperative “reactive hypertension” causes included coughing, retching or vomiting, postoperative pain, and anxiety. In their study they discovered most patients demonstrated significant increases in blood pressure 3 hours after surgery compared with their preoperative levels, increasing their risk of hematoma formation. In accordance with these studies, Baker et al²² reported an overall decreased incidence of postoperative hematoma from 8.7% to 3.97% over a



Figure. Postoperative hematoma in a patient receiving perioperative thromboembolic chemoprophylaxis after an excisional body contouring procedure.

35-year period, after the initiation of a strict antihypertensive and perioperative blood pressure control regimen of chlorpromazine, valium, and clonidine.

Hussien et al¹⁸ also found intraoperative hypotension to be associated with an increase in the development of wound hematoma in patients undergoing breast reduction. Significant fluctuations in blood pressure may lead to hematoma formation in a couple of ways. As previously mentioned, intraoperative hypotension masks the actual amount of non-discreet hemorrhage present during the operation, giving a false perception of adequate hemostasis. These lower pressures also assist in clot formation in the microvasculature, which are broken down as the patient returns to their normal blood pressure state. The administration of LMWH would only further increase the thrombolysis and bleeding of the surrounding vasculature during the postoperative recovery.

Abdominoplasty complications have been extensively reviewed throughout the literature.^{1,10,11,13,14,24,26,27} However, to our knowledge, there are no reports comparing hematoma rate and blood pressure in the excisional body contouring patient population, especially in the face of thromboembolic chemoprophylaxis. We recognize that our study is limited by its retrospective nature and selection bias. It is also important to acknowledge that our conclusions are based on mean

intraoperative blood pressures taken over the last 2 hours of the operation, with the assumption that hemostasis was achieved during this period of time and that our postoperative pressures were taken only 1 hour after surgery. Further study into areas of optimal intraoperative blood pressures and thresholds with regard to postoperative hematoma formation would be very helpful, as well as the relationship between prophylactic anticoagulation therapy and bleeding risk in the face of perioperative hypotension/hypertension.

In conclusion, our previous work has shown the benefit of chemoprophylaxis in select individuals undergoing body contouring surgery, and, on the basis of these findings, it seems unreasonable to withhold thromboembolic prophylaxis in the high-risk patient population on account of potential bleeding complications. Strict perioperative and intraoperative blood pressure control may prove invaluable in decreasing the risk of postoperative hematoma formation in patients undergoing excisional body contouring. Further study in a prospective randomized controlled fashion would be ideal to confirm our conclusions. However, because of the potential lethal complication of pulmonary embolus, this may prove to be difficult. With chemoprophylaxis becoming standard in certain surgical populations, it is important to attempt to minimize the possibility of all potentially preventable complications.

Deliberately induced hypotension has been used in plastic surgery to assist in hemostasis for more than 40 years.^{17,20,21,23} Our data support that induced hypotension may in fact be helpful for intraoperative hemostasis but may lead to the development of postoperative hematomas through blood pressure swings in patients undergoing body contouring with chemoprophylaxis. ■

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References

- Newall G, Ruiz-Razura A, Mentz HA, Patronella CK, Ibarra FR, Zarak A. A retrospective study on the use of a low-molecular-weight heparin for thromboembolism prophylaxis in large-volume liposuction and body contouring procedures. *Aesthetic Plast Surg* 2006;30:86-95; discussion 96-97.
- Geerts W, Ray JG, Colwell CW, Bergqvist D, Pineo GF, Lassen MR, Heit JA. Prevention of venous thromboembolism. *Chest* 2005;128:3775-3776.
- Geerts WH, Heit JA, Clagett GP, Pineo GF, Colwell CW, Anderson FA Jr, Wheeler HB. Prevention of venous thromboembolism. *Chest* 2001; 119(1 Suppl):132S-175S.
- Geerts W, Selby R. Prevention of venous thromboembolism in the ICU. *Chest* 2003;124(Suppl):357S-363S.
- Geerts WH, Pineo GF, Heit JA, Bergqvist D, Lassen MR, Colwell CW, Ray JG. Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. *Chest* 2004;126(Suppl):338S-400S.
- Dharmarajan TS, Sohagia A. Low-molecular-weight heparin and bleeding: how do we lower risk but maintain benefit? *Ann Intern Med* 2006;145:789-790.
- Durnig P, Jungwirth W. Low-molecular-weight heparin and postoperative bleeding in rhytidectomy. *Plast Reconstr Surg* 2006;118:502-507; discussion 508-509.
- Lim W, Dentali F, Eikelboom JW, Crowther MA. Meta-analysis: low-molecular-weight heparin and bleeding in patients with severe renal insufficiency. *Ann Intern Med* 2006;144:673-684.
- van Wijk FH, Wolf H, Piek JM, Buller HR. Administration of low molecular weight heparin within two hours before caesarean section increases the risk of wound haematoma. *BJOG* 2002;109:955-957.
- Avelar JM. Abdominoplasty combined with lipoplasty without panniculus undermining: abdominoplasty—a safe technique. *Clin Plast Surg* 2006;33:79-90, vii.
- Grazer FM, Goldwyn RM. Abdominoplasty assessed by survey, with emphasis on complications. *Plast Reconstr Surg* 1977;59:513-517.
- Grover R, Jones BM, Waterhouse N. The prevention of haematoma following rhytidectomy: a review of 1078 consecutive facelifts. *Br J Plast Surg* 2001;54:481-486.
- van Uchelen JH, Werker PM, Kon M. Complications of abdominoplasty in 86 patients. *Plast Reconstr Surg* 2001;107:1869-1873.
- Matarasso A, Swift RW, Rankin M. Abdominoplasty and abdominal contour surgery: a national plastic surgery survey. *Plast Reconstr Surg* 2006;117:1797-1808.
- Mohammad JA, Warnke PH, Stavraky W. Ultrasound in the diagnosis and management of fluid collection complications following abdominoplasty. *Ann Plast Surg* 1998;41:498-502.
- Ellis MH, Hadari R, Tchuvrero N, Shapira S, Kovlenko I, Kozmiakova M, et al. Hemorrhagic complications in patients treated with anticoagulant doses of a low molecular weight heparin (enoxaparin) in routine hospital practice. *Clin Appl Thromb Hemost* 2006;12:199-204.
- Gallozzi E, Blancato LS, Stark RB. Deliberate hypotension for blepharoplasty and rhytidectomy. *Plast Reconstr Surg* 1965;35:285-290.
- Hussien M, Lee S, Malyon A, Norrie J, Webster M. The impact of intraoperative hypotension on the development of wound haematoma after breast reduction. *Br J Plast Surg* 2001;54:517-522.
- Rees TD, Barone CM, Valauri FA, Ginsberg GD, Nolan WB 3rd. Hematomas requiring surgical evacuation following face lift surgery. *Plast Reconstr Surg* 1994;93:1185-1190.
- Rees TD, Lee YC, Coburn RJ. Expanding hematoma after rhytidectomy. A retrospective study. *Plast Reconstr Surg* 1973;51:149-153.
- Straith RE, Raju DR, Hipps CJ. The study of hematomas in 500 consecutive face lifts. *Plast Reconstr Surg* 1977;59:694-698.
- Baker DC, Stefani WA, Chiu ES. Reducing the incidence of hematoma requiring surgical evacuation following male rhytidectomy: a 30-year review of 985 cases. *Plast Reconstr Surg* 2005;116:1973-1985; discussion 1986-1977.
- Berner RE, Morain WD, Noe JM. Postoperative hypertension as an etiological factor in hematoma after rhytidectomy. Prevention with chlorpromazine. *Plast Reconstr Surg* 1976;57:314-319.
- Bullocks. Prevention of hematomas and seromas. *Semin Plast Surg* 2006;20:233-240.
- Jones BM, Grover R. Avoiding hematoma in cervicofacial rhytidectomy: a personal 8-year quest. Reviewing 910 patients. *Plast Reconstr Surg* 2004;113:381-387; discussion 388-390.
- Stocchero IN. Ultrasound in the diagnosis and management of fluid collection complications following abdominoplasty. *Ann Plast Surg* 2004;52:331.
- Floros C, Davis PK. Complications and long-term results following abdominoplasty: a retrospective study. *Br J Plast Surg* 1991;44: 190-194.

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