

Comparative evaluation about the efficacy of the use of variable concentrations of epinephrine in Tumescence solution for control of bleeding in patients with abdominal liposuction

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Abstract

Objective: The use of epinephrine for controlling the blood loss has gained out in many dermatological surgeries; however, its use in liposuction has not been studied. In this regard, we aimed to figure out the effectiveness of using epinephrine in tumescent solution during liposuctions surgery.

Methods: In this study, we present a prospective, double-blind, non-randomized study evaluating the effects of adding epinephrine to tumescent solution intraoperative in patients undergoing liposuction. Thirty-six patients including 6 males and 29 females undergoing liposuction were divided into two groups. In case group, we use 1–1.4 mg/L epinephrine (based on the location of surgery) in tumescent solution; and control group did not receive epinephrine. Lab data such as hemoglobin and hematocrit as well as clinical data including blood pressure and heart rate were recorded before, after 1 h, and 6 h of liposuction.

Results: In this study, we observed that both case and control group faced a significant drop in their hemoglobin and hematocrit levels; however, the decrement was significantly lower in case group. In addition, both groups had a stable hemostasis after 1 h and 6 h of surgery. In this regard, we did not observe any significant difference between heart rate and blood pressure of two groups.

Conclusion: The results of this study suggest that using epinephrine as vasoconstriction agent in tumescent solution might decrease the rate of bleeding and increase the chance of stable hemostasis both during and after abdominal liposuction.

Keywords: Liposuction, epinephrine, blood loss, bleeding control, hemostasis.

Introduction

Liposuction remains one of the most widely cosmetic surgical procedures and is increasingly widespread every year.¹ However, since its introduction, legitimate fears over patient welfare have contributed to restrictions on the amount of fat that can be sucked.²⁻⁴ These limits are primarily determined by hemodynamic variations and blood loss that may arise during liposuction.⁴ Previously, it has been shown that tranexamic acid, as an anti-fibrinolytic agent, could prevent the conversion of plasminogen to plasmin in a competitive manner, and prevent the binding and degradation of fibrin and maintaining the basis of its matrix structure.⁵ Studies in various medical areas, such as orthopedic surgery, cardiology, and gynecology, have demonstrated that it can minimize blood loss and transfusion needs.⁶⁻⁸ In recent years, the surgical use of tranexamic acid to prevent blood loss has been resurrected and the use of tranexamic acid has been co-opted by cosmetic surgeons to limit intraoperative bleeding.⁹ This has been found to be especially successful in burns and craniomaxillofacial and cosmetic procedures. Although several publications have cited its use in liposuction, its effectiveness in reducing pre-operative blood loss during liposuction has not yet been studied.¹⁰

On the other hand, epinephrine is the most widely used blood vessel constrictor and blood coagulation accelerator, particularly on the skin or mucous membranes to control bleeding at the site of the operation.^{6,7} It can reduce the absorption of local anesthetics into the bloodstream, resulting in decreased systemic toxic side effects, longer therapeutic duration of action, and decreased blood loss.¹¹ The effect of

epinephrine, with its non-selective adrenergic properties on the skin and subcutaneous tissues, in a local anesthetic solution is exerted by the constriction of local vasculatures and a decrease in local blood flow.^{8,9}

Epinephrine, however, has serious side effects and there are some drawbacks owing to possible dose-related heart effects.⁷ In addition, the change in its concentration tends to have various effects on the severity of bleeding in the surgical cut.¹² The optimum dosage of epinephrine for the prevention of bleeding has still not been specifically established and is controversial in dermatological surgery.⁹⁻¹² This research was conducted to assess the influence of dose-dependent epinephrine supplementation in local anesthesia on intraoperative bleeding regulation, and also to assess its effects on hemodynamic properties during dermatological surgery. Based on the above-mentioned information, we aimed to figure out the effectiveness of using epinephrine in tumescent solution during liposuctions surgery.

Material and Methods

In this study, we present a prospective, double-blind, non-randomized study evaluating the effects of adding epinephrine to tumescent solution intraoperative in patients undergoing liposuction. Thirty-six patients including 6 males and 29 females undergoing liposuction were divided into two groups (n=18 in each group).

In this study, inclusion criteria were as follows: patients who were referred for abdominal liposuction surgery, have a complete pre-operative examination with a history and examination without any problem or liposuction contraindication.

In this study, liposuction surgery of the abdomen and flanks liposuction are conducted without any other surgery. All cases in both control and experimental groups are performed by the same expert cosmetic surgeon and team in one surgical center with the same lipomatic device. The body mass indexes were between 30 and 40 and the volume of transfused tumescent liquid was equal to the volume of lipid which has been aspirated from patient.

Due to the lower density of fat tissue in lower abdominal and lower risk of bleeding in this region, we used 1 mg/L of epinephrine in these cases and we add epinephrine at the dose of 1.4 and 1.2 mg/L in cases with liposuction of right/left flanks and upper abdomen, respectively. In addition, we monitor the blood pressure and pulse rate during the surgery and every 6 h after surgery. Also, we routinely check anemia and hypovolemia by evaluating the hemoglobin and hematocrit before and 24 h after surgery to possible blood transfusion after surgery.

The data were described by frequency (percentage (%)) or mean \pm SD, and the comparison between the two groups was tested by k^2 test. All statistical analysis was implemented in SPSS 25.0, P-values <0.05 were considered statistically significant.

Results

Of the 36 cases enrolled in the current study, 18 were enrolled in the control group and 18 in the control group, with a total of 7 men (19.4%) and 29 women (80.6%). There were 3 men (16.7%) and 15 women (83.3%) in the control group. In the control group, there were 4 men (22.2%) and 14 women (77.8%). The overall mean age of case group was 40.69 ± 8.75 years with a maximum age of 56 years and a minimum of 26 years. In the control group, the mean was 43 ± 9.09 with a maximum age of 56 and a minimum of 28 years. The mean age in case group was 38.3 ± 7.9 years with a maximum age of 56 and a minimum of 26 years. All details have been mentioned in the Table 1. Our results showed no significant difference alongside with these two groups regarding to age and genders (case and control, $P > 0.05$).

An average of 3.5 L of fat has been sucked during the liposuction procedure, with a maximum of 7 L and a minimum of 3.5 L. In addition, the results failed to show any significant difference between tow control and case groups ($P > 0.05$).

The hemoglobin of case group was 13.2 before liposuction became 12.5 after 24 h; and the control group had the mean hemoglobin of 12.9 before and 11.35 after surgery. The results showed a significant higher rate of hemoglobin in case group in comparison to control group after surgery but not before ($P < 0.05$). Hematocrit also increased from 39.2% in the control group to 37.78 after the intervention, but in the control group hematocrit dropped from 38.68 to 34.65 after the intervention, which was also a significant difference between the two groups after intervention ($P < 0.05$).

On the other hand, the systolic blood pressure in the control group increased from 124.7 to 127.5 in the first hour and dropped into 124.72 in the next 6 h; and in the control group, the systolic blood pressure decreased from 123.33 to 120.0 in the first hour to 116.38 in the next 6 h. The difference was not significantly different between two groups before and after surgery ($P > 0.05$). In addition, the diastolic blood pressure was not statistically significant between the two groups ($P > 0.05$).

In terms of heart rate, in the control group, the mean heart rate before the intervention was 83.66 bpm and 1 h after the intervention was 88.61, and 6 h after the intervention was 83.72; in the control group heart rate before the surgery was 79.61 and 1 h after was 78.61, and 6 h later, it was 77.5. There was no significant difference between two groups ($P > 0.05$).

Table 1. The statistical reports in two case and control groups.

Item	Total no. patients	Mean \pm SD	P value
Age	36	40.69 \pm 8.75	0.328
Case	18	38.3 \pm 7.9	
Control	18	43 \pm 9.09	
Gender (M:F)	36		0.873
Case	18	4:14	
Control	18	3:15	
Hemoglobin before	36		0.491
Case	18	13.2 \pm 1.3	
Control	18	12.9 \pm 1.1	
Hemoglobin after	36		0.039
Case	18	12.5 \pm 1.2	
Control	18	11.35 \pm 0.92	
Hematocrit before	36		0.383
Case	18	39.2 \pm 3.9	
Control	18	38.68 \pm 3.2	
Hematocrit after	36		0.048
Case	18	37.78 \pm 3.3	
Control	18	34.65 \pm 3.5	
Blood pressure before	36		0.771
Case	18	124.7 \pm 10.9	
Control	18	123.33 \pm 11.3	
Blood pressure 1 h later	36		0.569
Case	18	127.5 \pm 10.5	
Control	18	120.0 \pm 9.4	
Blood pressure 6 h later	36		0.388
Case	18	124.7 \pm 9.7	
Control	18	116.38 \pm 8.8	
Pulse rate before	36		0.719
Case	18	83.6 \pm 5.0	
Control	18	79.61 \pm 5.8	
Pulse rate 1 h later	36		0.823
Case	18	88.6 \pm 5.6	
Control	18	78.61 \pm 5.1	
Pulse rate 6 h later	36		0.533
Case	18	83.7 \pm 5.2	
Control	18	77.5 \pm 4.1	

Discussion

According to the current study, it seems that increasing the dose of epinephrine is effective in reducing bleeding due to abdominal suction; and increasing the dose of epinephrine significantly reduced the both hemoglobin and hematocrit, but this issue was seen in control as well. In addition, there was no statistically significant change in blood pressure and heart rate of the cases because these parameters might be affected by other conditions in the subject, such as pain and anxiety due to surgery.

Several randomized experiments were justified in order to offer definitive proof as to the impact of epinephrine on hemorrhage during various forms of operations.¹³⁻¹⁵ Epinephrine is a sympathomimetic amine with beta-adrenergic agonist receptor effects. Various arterioles, particularly in the skin and mucosa, exhibit vasoconstriction due to the prevailing stimulation of the α -receptor.⁴ The minimum dosage of epinephrine to achieve sufficient and minimal toxic effect on hemostasis is yet to be specifically defined in dermatological surgery. Few experiments remain in the literature to determine the optimum dosage of epinephrine in human subjects. In this regard, previous studies have shown that local anesthetics with 1:100,000 epinephrine, have been suggested to be consistent of sufficient vasoconstriction.¹⁶ Regulation of the dosage of epinephrine as a vasoconstrictor not only decreases the magnitude of unintended results, but can also decrease intraoperative bleeding.¹⁷

Epinephrine in combination with local anesthetic solution has been found to minimize perioperative bleeding from surgical wound sites in a variety of surgical environments.¹⁸⁻²⁰ It has been shown that the 1:50,000 dose of epinephrine can have the highest hemostasis when used as an infiltration injection.²¹ However, owing to its rebounding activity and systemic cardiovascular side effects such as tachycardia, it can be used sparingly.²² In our research, hemodynamic changes such as heart rate and systolic blood pressure were not observed following surgery. Also, in the current study, no side effects were observed due to increasing the dose of epinephrine, and also considering the cheapness and availability of this drug in terms of cost-effectiveness, it seems reasonable to use a higher dose of this drug depending on the surgeon. Major hemodynamic changes, especially hypotension, have been reported in a lidocaine-receiving community with 1:200,000 epinephrine. However, these improvements were found to have lasted no longer than 4 min.²³ In another analysis of 3rd- to 6th-min heart rate, systolic arterial pressure from 3rd- to 5th-min and diastolic arterial pressure from 2nd- to 6th minute following local injection were both higher in patients with higher epinephrine concentrations.²⁴

Overall, this study showed that using epinephrine is safe in liposuction surgery when used with tumescent solution. This issue could decrease the rate of blood transfusion to reduce the viral and bacterial infection, and increase the economically and psychologically imposed on the patient.

Conclusion

The results of this study suggest that using epinephrine as vasoconstriction agent in tumescent solution might decrease the rate of bleeding and increase the chance of stable hemostasis both during and after abdominal liposuction.

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