

Ultrasound-Assisted Liposuction and Helium-Activated Radiofrequency Skin Tightening for Treatment of Paradoxical Adipose Hyperplasia After Cryolipolysis

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Abstract

Paradoxical adipose hyperplasia (PAH) following cryolipolysis is a rare but deforming complication. This likely underreported adverse event has been described as being refractory to both traditional tumescent liposuction and repeated cryolipolysis treatments. Here, we present 3 isolated cases with PAH deformity created by cryolipolysis. Management of PAH on the abdomen and flanks involved 2 key elements: ultrasound-assisted liposuction (UAL) technology and helium-activated radiofrequency (RF) energy subdermal coagulation. We observed complete resolution and definitive correction of PAH deformities at 2 weeks, 1 month, and 3 months postoperatively. UAL combined with helium-activated RF subdermal coagulation is a viable surgical modality to correct contour irregularities seen in PAH following cryolipolysis.

Keywords

cryolipolysis, paradoxical adipose hyperplasia, ultrasound-assisted liposuction, high-definition liposuction, case report

Introduction

Liposuction and body contouring are among the most popular surgical procedures. In recent years, cryolipolysis has been implemented as a noninvasive means of reducing subcutaneous adipose tissue by selectively inducing apoptosis in adipose cells without harming adjacent tissues. This technique became available in June 2009 and more than 4 000 000 cryolipolysis procedures have been performed worldwide.^{1,2} The exact mechanism of subcutaneous or superficial fat layer loss is not yet completely understood.³ Cold-induced panniculitis is involved, with injury of adipocytes and inflammation correlated with tissue loss.⁴ Manstein et al demonstrated fat reduction confined to the superficial fat, with deep fat appearing less affected.

Paradoxical adipose hyperplasia (PAH) is a rare but serious adverse event associated with cryolipolysis that is likely underreported.^{5,6} PAH begins typically a few months after treatment and is characterized by disorganized adipocytes of varying sizes, fibrotic changes, and perilobular septal thickening.^{5,7} The underlying pathogenesis of PAH is yet to be elucidated. There appears to be a slightly higher incidence in the abdomen of males.^{1,7,8} Although traditional tumescent liposuction has been proposed as a treatment for PAH, Friedmann et al reported a case of PAH after

cryolipolysis refractory to tumescent liposuction.⁹ William Stefani reported that repeated cryolipolysis treatments in a 29-year-old male showed no improvements, suggesting that repeated treatments may actually make PAH worse.¹

Case Descriptions

A 22-year-old female, 49-year-old male, and a 52-year-old male presented for management of enlarged adipose collection in the abdomen and flanks, which was created by cryolipolysis. The patients all had history of slight weight gain since treatment with cryolipolysis. The 52-year-old patient was offered a second treatment of cryolipolysis but declined due to reports of PAH being refractory to additional treatments. The patients' abdomen and flank demonstrated localized adiposity in 6 areas corresponding to

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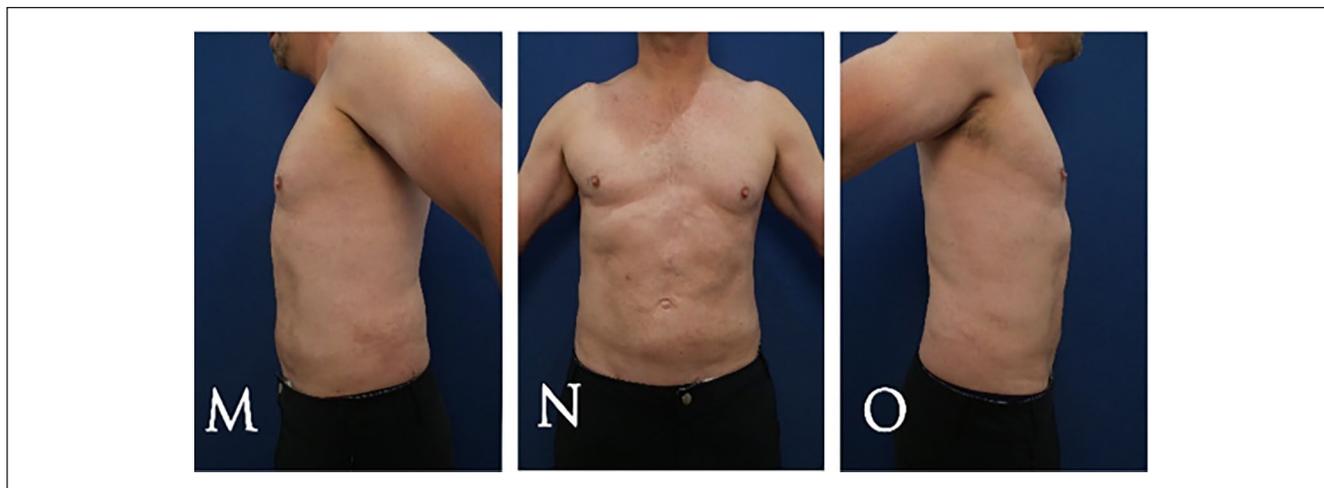


Figure 1. Photographs of a 52-year-old male: (A-C) preoperative. (D-F) preoperative: with markings. (G-I) postoperative: 2 weeks. (J-L) postoperative: 4 weeks. (M-O) postoperative: 3 months.

areas treated with cryolipolysis paddles. The 22-year-old female patient presented 5 areas corresponding to areas treated with cryolipolysis paddles. The 49-year-old male presented a central PAH deformity in the abdomen. All patients' medical history was unremarkable, including no smoking history. They individually elected to attempt ultrasound-assisted liposuction (UAL) 1 year following their cryolipolysis.

All 3 patients underwent UAL with 2 elements: VASER liposuction with a 3.3-mm 5-ringed probe at 80% power and 6 passes of helium-activated radiofrequency (RF) Renuvion subdermal coagulation at 80% power and 3 L/min of helium flow. Tumescence solution was used to infiltrate and aspirate. Approximately 600cc was infiltrated into each of the areas of excess adiposity, and another 1000cc was infiltrated throughout the abdomen for adjacent sites. All areas of the abdomen and flank including areas of PAH were comprehensively liposuctioned such that deep and superficial layers of fat were removed entirely. Helium-activated RF was used to tighten areas of skin redundancy following liposuction at PAH-treated areas. In the case of the 49-year-old male, he presented excess skin redundancy that was excised following the liposuction procedure intra-operatively.

Port sites were repaired and the patient tolerated the procedure well. Incisions were dressed with benzoin and steri-strips. The patients were extubated, and compression garments and dressings were applied throughout. Patients received 5 postoperative lymphatic massages beginning the day after surgery and continuing every other day until day 10.

Postoperatively at 1 week, the patients' flanks and abdomen were aesthetically pleasing in contour. Findings were similar at follow-up intervals of 2 weeks, 4 weeks, and 3 months (Figure 1). Incision lines were clean, dry, and intact, with no sign of infection. Drains were removed, and the patient was counseled on avoiding physical exercise and on

scar management. The patients were offered additional lymphatic RF massage at 5 weeks. Patient photos obtained at 2 weeks, 4 weeks, and 3 months postoperatively demonstrated aesthetically pleasing contour with no recurrence of PAH. Results showing resolution of PAH are shown in Figures 1 to 3.

Discussion

Cryolipolysis is an increasingly popular noninvasive fat-reduction technique involving selective apoptosis of subcutaneous adipocytes following cold exposure. The mechanism, though not completely understood, involves adipocyte crystallization, apoptosis, and elimination by macrophage engulfment¹⁰ that is confined to the superficial fat layer.

PAH is a complication of cryolipolysis, which seems to involve expansion of the deep fat left untouched by cryolipolysis treatments (Figure 4).

It appears that after changes are made in the superficial fat layer through cryolipolysis, the deep fat layer is presented with no mechanical restriction to growth, and expansion of the deeper fat layer can occur unimpeded. This event may be encouraged by even slight weight gain, as was observed in our cases. PAH has been shown to be refractory to traditional liposuction or additional treatments with cryolipolysis. Cryolipolysis is most effective in treating the superficial layer of fat and therefore may not be as effective in treating the expanding deeper fat observed in PAH.

Similarly, traditional liposuction may also not achieve smooth results: First, even though the deep layer of the PAH region may be reduced significantly, any residual fat left behind may be prone to regrowth; second, there may be mismatch of contour between the treated area and the adjacent nontreated areas. Nontreated areas will still have their



Figure 2. Preoperative markings on a 22-year-old female presented for management of abdominal region deformities created by cryolipolysis: (A) Left oblique. (B) Front. (C) Right oblique.

Note. This patient has not returned for her 3-month postoperative photos yet.

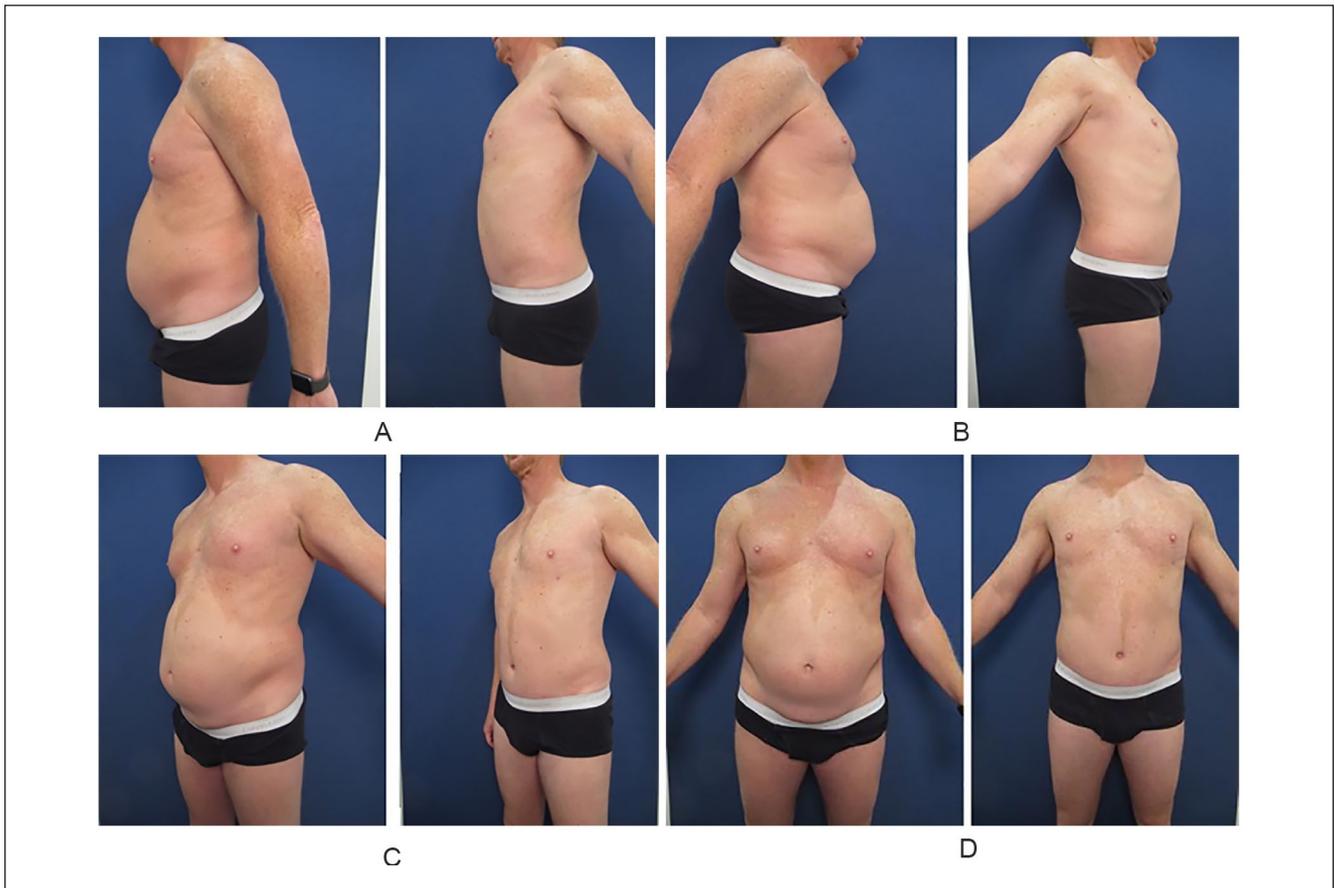


Figure 3. A 49-year-old male presented for management of PAH over the abdomen and flanks created by cryolipolysis: (A) Left side. (B) Right side. (C) Left oblique. (D) Front.

Note. The patient presents 3 months following ultrasound-assisted liposuction, surgical skin excision, and helium-activated RF subdermal coagulation. He demonstrates an aesthetically pleasing abdomen and correction of PAH deformities. PAH = paradoxical adipose hyperplasia; RF = radiofrequency.

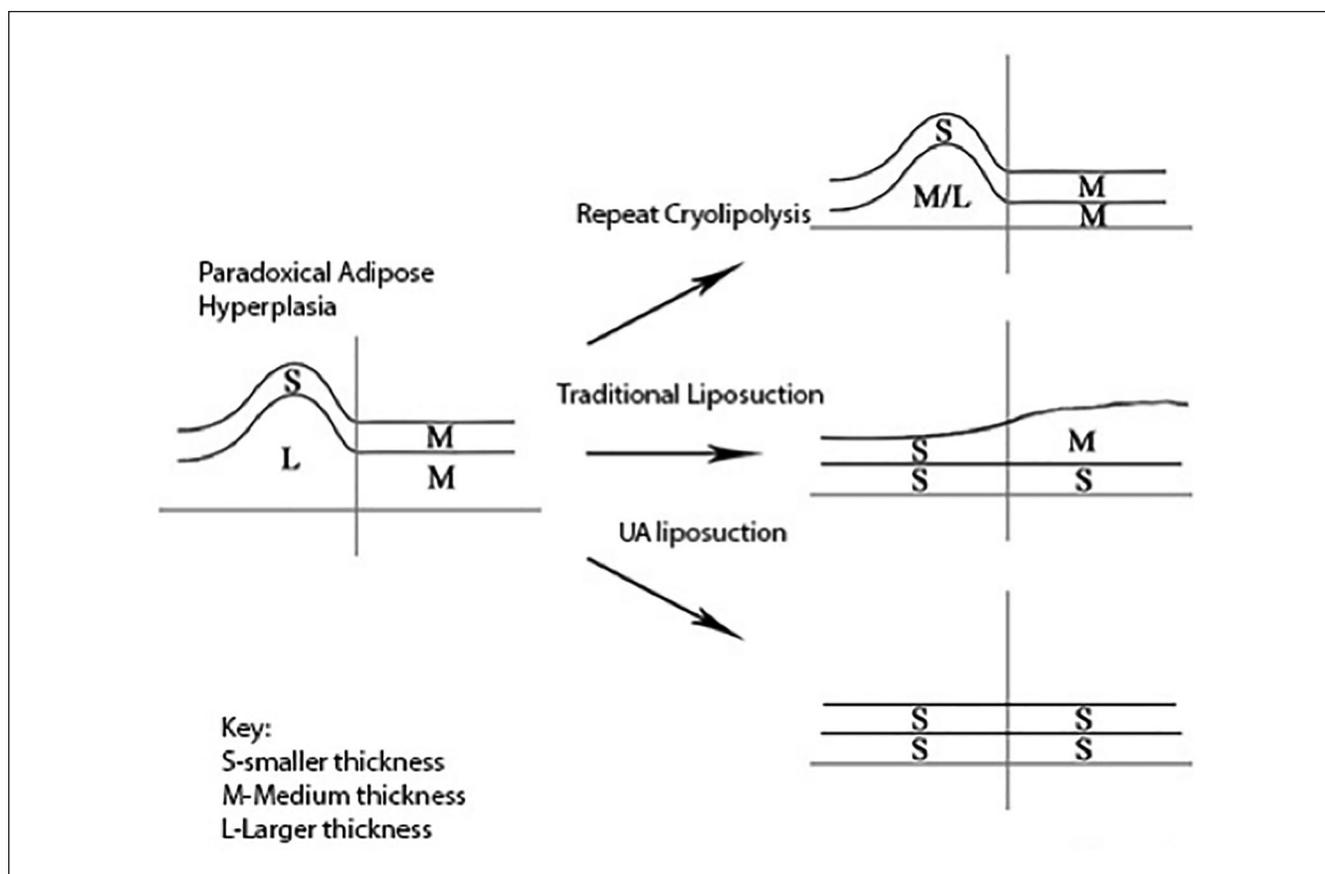


Figure 4. Paradoxical adipose hyperplasia deformities result in deep fat layers pushing up under superficial fat layers.

Note. Here, we demonstrate how ultrasound-assisted (UA) liposuction treats the problem, while repeat cryolipolysis treatments ignore the underlying issue.

superficial fat content retained, a layer not effectively treated by traditional liposuction.

In contrast, our findings suggest that high-definition UAL involves comprehensive reduction of both deep and superficial fat layers, thus providing a more permanent correction of PAH regardless of future patient weight fluctuation. Skin redundancy that may be created by expansion from PAH and following UAL is minimized with helium-activated RF skin tightening, which uses low-current cold atmospheric plasma rather than traditional RF or laser energy, to contract the collagen when applied subdermally.

Conclusions

The current study suggests that high-definition UAL with helium-activated RF subdermal coagulation treats both superficial and deep fat layers, providing an effective treatment for PAH following cryolipolysis. We saw successful elimination of PAH deformities, from the submental region to the abdominal region, by using UAL and helium-activated RF treatments—that are more effective and permanent than traditional liposuction. Both male patients demonstrated

aesthetic improvement of body contour and elimination of deformities. Additional studies are needed to better understand the mechanisms of PAH following cryolipolysis as well as the physiology of observed clinical benefits of UAL technology for treatment of PAH.

Authors' Note

The paper is presented at the World Congress on Liposuction in September 2019 in Chicago, Illinois, USA.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: I am the lead author on this page and am a paid trainer for VASER by Solta Medical and Renuvion by Apyx Medical. Dr. Hamlet is a paid trainer for VASER by Solta Medical. The other authors declare no conflicts of interest in regard to the research, authorship, and/or publication of this article.

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