



## Introduction

Hematomas are one of the most frequently reported complications in aesthetic surgery. They can range in size and may present with a variety of nonspecific signs and symptoms. While smaller hematomas may resolve without incident, larger hematomas, if left untreated, can have untoward consequences for the patient including pain, poor cosmetic outcome, scarring, as well as skin and tissue ischemia leading to necrosis and infection.

» Hematomas are one of the most frequently reported complications in aesthetic surgery

Hematoma is a relatively common complication following rhytidectomy, which is one of the best studied aesthetic procedures with regards to hematoma rates. The reports on incidence range between



**Fig. 1** ▲ The subcutaneous flap is outlined and the head is slightly turned with the assistant holding the traction of flaps. (Image courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)

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# Hemostatic net in facelift surgery

approximately 0% and 14% [1–4]. This complication can lead to devastating sequelae such as flap loss, airway compromise, infection, hyperpigmentation, increased recovery time, and a poor aesthetic result.

Risk factors predisposing to postoperative bleeding and hematoma formation have been previously identified and include demographic factors such as gender and smoking status, medical co-morbidities such as hypertension and malignancy, anticoagulant medications, surgical and anesthetic techniques, as well as postoperative management [5].

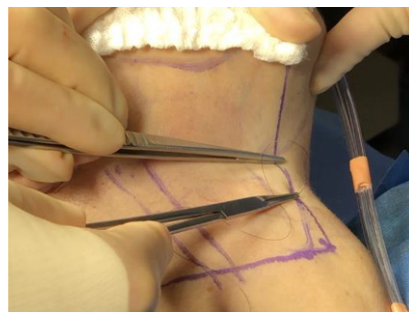
» A hemostatic net applied to all areas of skin elevation closes the dead space

In an effort to impact the incidence of hematoma formation following facelift, Auersvald and Auersvald developed a novel technique to essentially eliminate hematoma formation in the early high-risk post-operative period. The

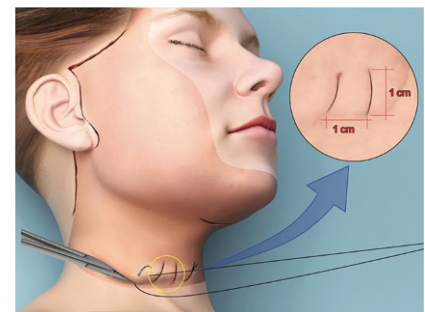
application of a hemostatic net to all areas of skin elevation closes the dead space, negating the potential of expansive bleeding [6].

## Concept

In 1998 Baroudi and Ferreira introduced the concept of internal quilting sutures in abdominoplasty to close the detached space in order to dramatically decrease the incidence of seroma [7]. Building on Baroudi's contribution, Pollock and Pollock described their experience utilizing progressive tension sutures in abdominoplasty procedures to not only eliminate dead space, but also securely advance the flap with incremental tension transferred from the skin closure incision to the superficial fascial system [8]. This concept of progressive subcutaneous sutures was then applied to facelift in order to achieve secure flap position, close the dead space, and improve the overall aesthetic outcome [9]. Due to the difficulty in precisely and completely covering the entire facelift flap, the internal quilting



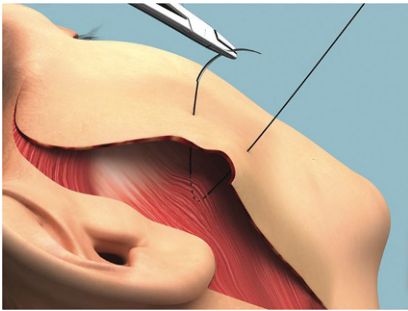
**Fig. 2** ▲ The net is initiated medially at the cervicomenal angle. (Image courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



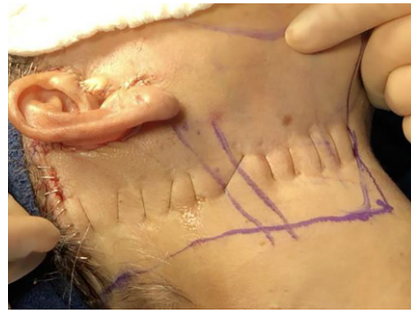
**Fig. 3** ▲ The suture passage creates a 1 cm<sup>2</sup> pattern with each passage spaced symmetrically at an equal distance. (Diagram used with permission from Andre Auersvald, MD)

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**Fig. 4 ▲** The suture encompassing the skin and the SMAS (superficial muscular aponeurotic system)-platysma. (Diagram used with permission from Andre Auersvald, MD)



**Fig. 5 ▲** The first line of suture ends in the most posterior portion of the retroauricular incision. (Procedure performed by T. Gerald O'Daniel, MD, FACS. Image courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 6 ▲** Placement of sutures continues with additional rows until all the dissected areas are covered by the hemostatic net. (Procedure performed by T. Gerald O'Daniel, MD, FACS. Image courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 7 ◀** Pre-hematoma evacuation showing expanding hematoma (a, b). Hematoma evacuated (c). (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 8 ▲** Intra-operative net placement. (Procedure performed by T. Gerald O'Daniel, MD, FACS. Image courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)

sutures in face- and necklifts were not widely adopted. Building on these concepts, Auersvald and Auersvald applied the principles of mechanical closure to their facelift procedures, formulating the technique of transcutaneous continuous transfixing sutures of the skin flaps to the deep tissues and creating a hemostatic net [6].

### Technique

The hemostatic net is applied after completion of the facelift procedure when the subcutaneous flaps have been tailored and inset. The borders of the subcutaneous dissection are marked as the boundaries for the application of the net. The net is created with continuous sutures that focus on closing the dead space between the skin of the face and neck with the corresponding deeper tissues of the superficial muscular aponeurotic system (SMAS) in the face and platysma in the neck. The net is accomplished utilizing

a Mononylon 5-0 suture with a triangular needle of at least 20 mm in length.

After marking the boundaries of the dissection and inset of the flaps, the head and neck are slightly extended and turned away from the side being addressed. The assistant will apply gentle pressure and traction to the flaps to ensure optimal skin redraping (■ Fig. 1). The first line of the net is initiated at the midline of the dissected neck at the position just below the newly created cervicomental angle (■ Fig. 2). The needle passage follows a uniform pattern entering perpendicular to the skin, then plunging into the platysma at 45 degrees and emerging at the same distance of 1 cm from the point of entry (■ Fig. 3). This spacing and mild traction on the suture by the assistant ensures that the suture will not be loose but also not too tense, thus preventing impairment to blood circulation. The SMAS-platysma is encompassed at each passage of the needle so as to bring it into contact with

the skin, thereby closing the dead space (▣ Fig. 4). The first line of suture ends in the most posterior portion of the retroauricular incision (▣ Fig. 5). The second line begins approximately 1 cm below, following parallel to the first and continues with additional rows until all the dissected areas are covered by the hemostatic net (▣ Fig. 6).

All of the patients shown here were operated on as outpatients and discharged the same day from the surgical unit. The net was removed 48–72 h post-operatively.

» The hemostatic net is created with continuous sutures after completion of the facelift procedure

Removal was accomplished after cleaning the skin where the net was applied thoroughly with an alcohol solution to remove all dried blood. After ensuring the sutures were free of debris, the net was removed as with any simple suture by first cutting all knots, then cutting each loop and removing each single strand of suture.

## Results

Over a 10-month period the first author (TGOD) used the hemostatic net on 66 of 108 patients undergoing face- and/or necklift procedures. The other patients were treated with Tisseel, a fibrin sealant, and drains. Patients with Fitzpatrick skin type 1–5 were treated with the net. There were no hematomas in either group during this period. There was one small seroma in a patient treated with the net, which was successfully treated with aspiration and re-application of the net over the area for 48 h. There were no incidences of flap necrosis or flap loss. One patient had concerns about the hyperemic appearance of the suture marks at 2 weeks post-operatively, which was successfully and quickly resolved with a single pulsed-dye laser treatment. There was no incidence of post-inflammatory hyperpigmentation from the suture tracks.

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## Hemostatic net in facelift surgery

### Abstract

Hematomas are one of the most frequently reported complications in aesthetic surgery. Risk factors predisposing to postoperative bleeding and hematoma formation have been previously identified and include gender and smoking status, hypertension and malignancy, anticoagulant medications, surgical and anesthetic techniques, as well as postoperative management. In an effort to impact the incidence of hematoma formation following facelift, Auersvald and Auersvald developed a novel technique to eliminate hematoma formation in the early high-risk post-operative period. The application of

a hemostatic net to all areas of skin elevation closes the dead space, negating the potential of expansive bleeding. The hemostatic net has proven to be a safe and effective method to prevent hematoma in the early post-operative period. The technique also enhances the surgeon's ability to accommodate severely lax cervicofacial skin.

### Keywords

Hematoma · Aesthetic procedure · Dead space · Suturing technique · Superficial muscular aponeurotic system

## Hämostatisches Netz bei Facelift

### Zusammenfassung

Hämatome sind eine der häufigsten Komplikationen in der ästhetischen Chirurgie. Zu den bereits identifizierten Risikofaktoren für postoperative Blutungen und Hämatombildung zählen das Geschlecht und der Raucherstatus, Hypertonie und maligne Erkrankungen, die Einnahme von Gerinnungshemmern, Operations- und Anästhesieverfahren sowie das postoperative Management. In ihrem Bemühen, die Inzidenz der Hämatombildung nach Facelift zu senken, haben Auersvald und Auersvald ein neuartiges Verfahren entwickelt, mit dem die Entstehung von Hämatomen in der frühen Hochrisikophase nach Operation unterbunden werden soll.

Durch Einsatz eines hämostatischen Netzes in allen Bereichen mit Hauterhebung wird der Totraum geschlossen, was potenzielle ausgedehnte Blutungen unterbindet. Das hämostatische Netz hat sich als sicheres und wirksames Mittel zur Hämatoprävention in der frühen postoperativen Phase erwiesen. Zudem erleichtert das Verfahren dem Chirurgen die Versorgung von sehr schlaffer zervikofazialer Haut.

### Schlüsselwörter

Hämatom · Ästhetisches Verfahren · Totraum · Nahttechnik · Superfizielles muskuloaponeurotisches System

A review of the charts identified the indications for application of the net. Indications included patients with poorly controlled hypertension as identified by blood pressure trends during the procedure, all male patients, patients deemed likely to be less compliant in the post-operative period, patients with extreme laxity of neck skin, and all patients undergoing procedures on Fridays.

» The net also improved skin redraping in cases of excessive, poor quality cervical skin

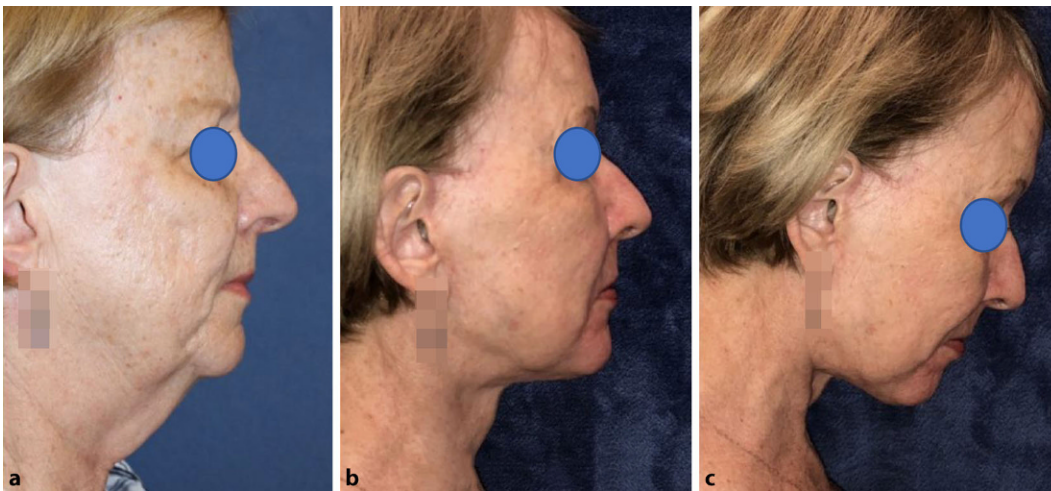
The first patient in whom the authors initiated use of the hemostatic net was

a 68-year-old female that had undergone outpatient face- and necklift including deep cervical surgery with management of deep fat, digastric muscles, and submandibular gland reduction. She presented to the surgical center 24 h post-operatively with an expanding hematoma in her face and neck. In addition, she exhibited hypertension that was refractory to multiple hypertensive medications (▣ Fig. 7). The hematoma was evacuated in the operating room utilizing dexmedetomidine IV sedation, which ultimately lowered the blood pressure. Faced with the risk for recurrent bleeding on discharge, the hemostatic net was applied after complete evacua-





**Fig. 9** ▲ Pre-operative image (a) and subsequent follow up (b: 6 days post-op; c: 10 days post-op; d: 3 weeks post-op). (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 10** ◀ Preoperative image (a) and 5.5 months follow-up (b, c). (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 11** ▲ Patient (80 years with Parkinson's) shown pre-operatively (a). Intra-operative appearance of the net (b, c). The specimen includes submandibular gland, digastric muscle, and deep central fat. Note the net was applied to the subcutaneous undermined area. (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)





**Fig. 12** ▲ Documentation of the neck pre-operatively (a) and at 48 h (b), 10 days (c), and 2 weeks post-operatively (d). (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 13** ◀ Pre-operatively (a) and 6 months post-operatively (b). (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)



**Fig. 14** ◀ Pre-operatively (a) and post-operative (b) flexion views. (Procedure performed by T. Gerald O'Daniel, MD, FACS. Images courtesy of T. Gerald O'Daniel, MD, FACS, O'Daniel Plastic Surgery Studios, Louisville, KY)

tion of the hematoma (■ Fig. 8). The net was removed at 48 h (■ Figs. 9 and 10).

In addition to eliminating the risk of hematoma in the early post-operative period, the authors found, as reported by Auersvald, that the net improved skin

redraping in cases of excessive, poor quality cervical skin. ■ Fig. 11 shows the pre-operative case of an 80-year-old man with severe skin laxity. This patient had risk factors for hematoma including hypertension and male gender

with the complicating co-morbidity of Parkinson's disease. He was treated with facelift with extensive subcutaneous cervical dissection and deep central neck surgery. His post-operative recovery was uneventful and he resumed normal activities at 2 weeks post-operatively (■ Figs. 11, 12, 13 and 14).

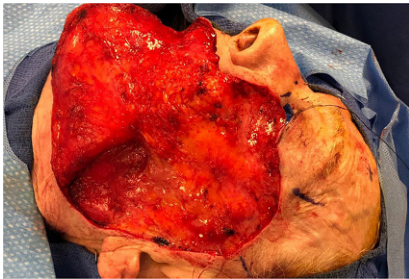
## Discussion

The occurrence of hematoma is a dreaded complication of all aesthetic procedures. In facelift surgery the occurrence of hematoma may lead to a more difficult post-operative recovery with prolonged edema and can compromise the final outcome by creating subsequent fibrosis and irregularities in the subcutaneous plane. Expanding hematomas that are delayed in diagnosis and treatment can result in catastrophic sequelae including flap ischemia and tissue loss leading to disfiguring scars and, in the worst-case scenario, life-threatening airway compromise [10, 11].

» The occurrence of hematoma is a dreaded complication of all aesthetic procedures

The authors' initial concerns related to the hemostatic net based on multiple cognitive biases. The authors' first impression was that the appearance of the net is

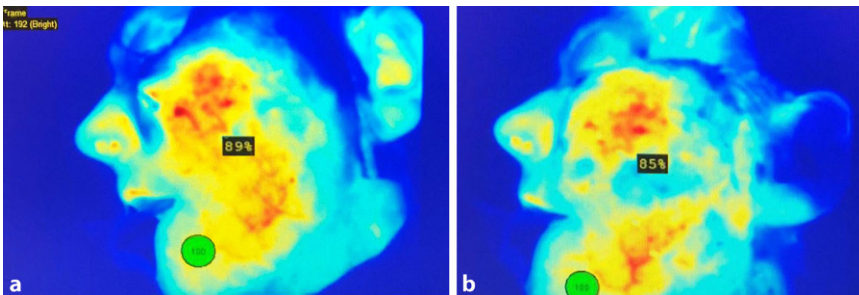




**Fig. 15** ▲ Post-melanoma resection of intra-operative defect to be reconstructed with cervicofacial flap. (Image used with permission from Jared Little, MD)



**Fig. 16** ▲ Intra-operative view of flap inset and net applied. (Image used with permission from Jared Little, MD)



**Fig. 17** ▲ Intra-operative SPY image after cervicofacial flap inset, before application of the net (a). Intra-operative SPY image after application of the net (b). (Images used with permission from Jared Little, MD)



**Fig. 18** ◀ The image shows the net in place (a). The patient 6 weeks post-operatively (b). (Images used with permission from Jared Little, MD)

series and, according to recent communication with AA (December 2018), the second two authors have not had scarring or hyperpigmentation in over 1200 facelifts using the net. The first author has had two patients decline use of the net for fear of tract marks despite communicating to them the extremely low risk.

The third concern related to tissue perfusion. The impression was that the sutures may compromise perfusion to the facelift flaps, leading to skin necrosis. There were no episodes of compromised perfusion or tissue loss in the first author's series. This is consistent with the reports of Auersvald and Auersvald [4, 6]. In addition, Dr. Jared Little of the University of Louisville recently utilized intra-operative laser angiography using the SPY System (LifeCell Corp., Branchburg, NJ, USA) for the assessment of perfusion in large cervicofacial flaps used for post-melanoma resection defect reconstruction (■ Figs. 15 and 16). The SPY was used to measure baseline flap perfusion after inset of the cervicofacial flap and showed 89% perfusion. The post-net application of SPY measured 85% perfusion (■ Fig. 17). The flap healed without event and the patient had a very satisfactory outcome (■ Fig. 18).

The final concern was related to the length of time it would take to apply the hemostatic net. The time required directly related to the amount of subcutaneous undermining. It was found that the time required ranged from 15 min to 35 min. When compared to the potential complications from hematoma, the authors found this time was worth the reduction in risk. The resources required and strain placed on the surgical staff and faculty when hematomas occur after hours and over the weekend have been negated. In addition, the authors have gained increased confidence in their ability to redrape the skin in the most advantageous position in cases of severe skin laxity. They have confidently raised cervical flaps extending to the clavicle to accomplish redistribution of skin without fear of hematoma in the lower neck where vascularity is considerable.

barbaric and would not be tolerated by the patient. To date, no patients have declined the net based on appearance.

The second concern was that scars would be created by the suture tracts. This was not experienced in the first author's

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### Practical conclusion

- The addition of the hemostatic net to the authors' facelift practice has proven to be a safe and effective method to prevent hematoma in the early post-operative period.
- The net enhances the authors' ability to accommodate severely lax cervicofacial skin by precise positioning of the flaps over the sculpted shape of the face created with the facelift procedure.

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### Compliance with ethical guidelines

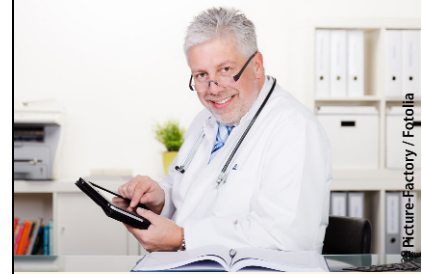
**Conflict of interest** T.G. O'Daniel, A. Auersvald and, L.A. Auersvald declare that they have no competing interests.

This article does not contain any studies with human participants or animals performed by any of the authors. For images or other information within the manuscript which identify patients, consent was obtained from them and/or their legal guardians.

### References

1. Grover R, Jones BM, Waterhouse N (2001) The prevention of haematoma following rhytidectomy: a review of 1078 consecutive facelifts. *Br J Plast Surg* 54(6):481–486
2. Beer GM, Goldscheider E, Weber A, Lehmann K (2010) Prevention of acute hematoma after facelifts. *Aesthetic Plast Surg* 34(4):502–507
3. Gupta V, Winocour J, Shi H, Shack RB, Grotting JC, Higdon KK (2016) Preoperative risk factors and complication rates in facelift: analysis of 11,300 patients. *Aesthet Surg J* 36(1):1–13
4. Auersvald A, Auersvald LA (2014) Hemostatic net in rhytidoplasty: an efficient and safe method for preventing hematoma in 405 consecutive patients. *Aesthetic Plast Surg* 38:1–9
5. Kaoutzanis C, Winocour J, Gupta V et al (2017) Incidence and risk factors for major hematomas in aesthetic surgery: analysis of 129,007 patients. *Aesthet Surg J* 37(10):1175–1185
6. Auersvald A, Auersvald LA, Biondo-Simões MLP (2012) Hemostatic net: an alternative for the prevention of hematoma in rhytidoplasty. *Rev Bras Cir Plast* 27:22–30
7. Baroudi R, Ferreira CA (1998) Seroma: how to avoid it and how to treat it. *Aesthet Surg J* 18:439–441

8. Pollock H, Pollock T (2000) Progressive tension sutures: a technique to reduce local complications in abdominoplasty. *Plast Reconstr Surg* 105(7):2583–2586 (discussion 2587)
9. Pollock H, Pollock T (2003) Management of facelifts with progressive tension sutures. *Aesthet Surg J* 23(1):28–33
10. Baker TJ, Gordon HL (1967) Complications of rhytidectomy. *Plast Reconstr Surg* 40:31–39
11. Rees TD, Lee YC, Coburn RJ (1973) Expanding hematoma after rhytidectomy: a retrospective study. *Plast Reconstr Surg* 51:149–153



### Ärzte genießen das höchste Ansehen in der Gesellschaft

#### Global Teacher Status Index 2018

Ärzte genießen weltweit das höchste berufliche Ansehen in der Gesellschaft. Zu diesem Ergebnis kommt der „Global Teacher Status Index 2018“ der britischen Varkey Foundation. In 35 Ländern befragte die Stiftung jeweils 1000 Menschen in der Bevölkerung zum Ansehen von Lehrern und anderen Berufen. Dabei kamen über alle Länder hinweg der Berufsstand der Ärzte mit einem Wert von 11,6 von 14 auf Rang 1 im gesellschaftlichen Ansehen vor Rechtsanwälten mit einem Wert von 9,5, gefolgt von Ingenieuren (9,1) und Schulleitern (8,1). Krankenpflegepersonal belegt mit einem Durchschnittswert von 7,4 den sechsten Platz.

**Quelle: Ärzte Zeitung,  
[www.aerztezeitung.de](http://www.aerztezeitung.de)**