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Experience of Hyperbaric Chamber Usage in Aesthetic Plastic Surgery Practice for Recovery and Complication Prevention

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Background: Hyperbaric oxygen therapy (HBOT) increases oxygen concentration in affected tissues that enhance the cellular hypoxia recovery process, neovascularization, fibroblast proliferation, increased reactive oxygen species, suppression of proinflammatory states, and vascular compression. The aim of this article is to demonstrate the experience in the use of the hyperbaric chamber as an adjunctive management for the prompt recovery of patients who underwent aesthetic plastic surgery.

Methods: A retrospective descriptive study was conducted between 2021 and 2023, involving 296 patients who received HBOT after aesthetic surgical procedures, to demonstrate the recuperation time rate and the complication incidence in postoperative patients using HBOT.

Results: Most participants were women, with a median age of 33.5 years. Surgical procedures were grouped in liposculpture, abdominoplasty, and breast interventions. Complications related to the surgical event were low (10.7%), with occurrences of hematomas (n = 14, 4.72%), anemias (n = 9, 3.04%), and wound dehiscence (n = 8, 2.70%). There were no reports of surgical site infections or necrosis. Recovery times to get back to work were 10 days for liposuction, 3 days for breast interventions, and 21 days for abdominoplasty.

Conclusions: This study demonstrated the experience of using a postoperative hyperbaric chamber in aesthetic plastic surgery to promote recovery processes. The patient cohort in this study showed shortened recovery times than the data obtained from the major international plastic surgery organizations. Also, HBOT patients had a low complication rate, without infections, indicating the potential efficacy of this adjunctive therapy. Overall, this study underscores the promising role of hyperbaric chamber therapy in facilitating postoperative recovery and mitigating complications. *(Plast Reconstr Surg Glob Open 2024; 12:e6264; doi: 10.1097/GOX.0000000000006264; Published online 5 November 2024.)*

INTRODUCTION

Hyperbaric chambers are a therapeutic option to increase oxygen concentration in tissues affected by various etiologies that cause cellular hypoxia. The mechanism by which the hyperbaric chamber increases oxygen availability in affected tissues is by increasing the atmospheric pressure at which the individual is located and by increasing the percentage of oxygen available in the environment (from 21% to 100%), facilitating the transport of dissolved oxygen in the blood once hemoglobin is maximally saturated.[1]

The use of the hyperbaric chamber produces physiological effects that favor a cellular hypoxia recovery process, such as increased dissolved oxygen in the blood, tissue oxygenation, clearance of other gases present in the affected area, neovascularization, fibroblast proliferation stimulation, increased reactive oxygen species, suppression of proinflammatory states, and vascular compression.[2–4] At the molecular level, the hyperbaric chamber has effects that favor the release of growth factors, recruitment of totipotent cells, and chemotaxis.[5]

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Hyperbaric oxygen therapy (HBOT) involves the patient inhaling 100% oxygen in an environment of at least 1.4 atm. Optional therapies often last 60–90 minutes at a pressure of 2–3 atm, with emergency treatments exceeding these parameters. The number of sessions is usually individualized for each patient based on their condition.[6]

Currently, the use of the hyperbaric chamber is indicated for pathologies such as gas embolism, carbon monoxide poisoning, gas gangrene, traumatic ischemia, decompression sickness, central retinal artery occlusion, wound healing problems, severe anemia, soft tissue necrosis and infection, intracranial abscesses, osteomyelitis, radiation injury, compromised grafts, burns, stroke, and myocardial infarction.[1] However, in the daily practice of aesthetic plastic surgery, the hyperbaric chamber is used for the recovery of patients who have undergone aesthetic procedures for a faster and more effective postsurgical recovery. This has become popular and is applied in a generalized manner among plastic surgeons based on empirical knowledge rather than adequate scientific evidence.

When verifying the use of this practice in aesthetic plastic surgery within the literature, no study was found to be conclusive with all the scientific validity to establish the effectiveness of hyperbaric chamber usage in aesthetic plastic surgery for rapid and effective patient recovery. However, a retrospective study shows that presurgical HBOT decreases postoperative complications in patients who undergo abdominoplasty.[7]

Also, several articles have shown some indications of usefulness in this field, such as the use of HBOT for flap management and ischemia, keloid scars, postoperative infection, skin ulcers, increased granulation tissue, prevention of implant encapsulation, survival of transfer cells, and hair implantation.[8–12]

Given the above, the aim of this article was to demonstrate the experience in the use of the hyperbaric chamber as an adjunctive management for the prompt recovery of patients who underwent aesthetic plastic surgery.

Takeaways

Question: Does hyperbaric oxygen therapy enhance the recovery of patients who undergo aesthetic plastic surgery?

Findings: A prospective descriptive study was conducted between 2021 and 2023, involving 296 patients who received hyperbaric oxygen therapy after aesthetic surgical procedures. Complications related to the surgical event were relatively low (10.7%), with occurrences of hematomas, anemia, and wound dehiscence. Patients undergoing hyperbaric therapy exhibited shortened recovery times and fewer postsurgical complications compared to the data from major international plastic surgery organizations.

Meaning: This study underscores the promising role of hyperbaric chamber therapy in facilitating postoperative recovery and mitigating complications, suggesting the necessity of protocols to optimize outcomes in aesthetic surgical practice.

METHODS

Study Design

A retrospective descriptive study was conducted. The data obtained from the patients' medical records were collected between 2021 and 2023. This information was related to the aesthetic surgical intervention, use of HBOT, and the postoperative follow-up.

Subjects

The study population consisted of patient records from Dr. Aguilar's practice at HAV Academy, Bogota, and Bucaramanga, Colombia (2021–2023). Participants included individuals who underwent aesthetic surgical procedures (liposuction, abdominoplasty, mastopexy, breast augmentation, and fat transfer) and received HBOT in the postoperative recovery; all patients were between 18 and 60 years. Patient records were excluded from the study in the event that the person could not complete the 5-day therapy due to a contraindication for hyperbaric chamber, the patient dropped out of the sessions, or the patient presented an intraoperative complication requiring immediate hospitalization or intervention by another specialty.

Hyperbaric Oxygen Therapy

Between 2021 and 2023, the postoperative patients were taken to postoperative hyperbaric chamber therapy 24 hours after their surgical intervention. The management protocol involved the patients undergoing daily sessions of HBOT for 45 minutes at a pressure of 2 atm for 5 days; all the patients got the same protocol. This therapy has an extra charge to the patients; each HBOT charge was around US $50.

Ethical Consideration

Each patient was informed to participate in the study and given the option to withdraw consent to participate at any time. An informed consent was signed before surgery for each patient participating in our report. The informed consent explained all the items according to the Declaration of Helsinki and Declaration of Taipei.

Statistical Analysis

The sociodemographic and clinical data of the patients were presented as frequencies, means, and SDs. Regarding the recovery of the patients, the average time for all stages of recovery of the study subjects was expressed in means. Additionally, the occurrence of postoperative complications was estimated. Statistical values were obtained using the Jamovi version 2.3 computer software, retrieved from https://www.jamovi.org).

RESULTS

A sample of 296 patients who received HBOT during the postoperative period of their aesthetic plastic surgery

was obtained, of which 280 were women (94.6%); the median age was 33.5 years [interquartile range (IQR) 11] (Table 1).

The surgical time had a median of 240 minutes (IQR 70 minutes), with the majority of individuals undergoing 2 procedures simultaneously (49.3%), followed by 3 procedures (34.1%); a smaller proportion underwent only 1 procedure (15.5%); and finally, those who underwent 4 simultaneous interventions (1%). Surgical procedures were classified into 3 main groups: liposculpture (n = 174, 58.7%), abdominoplasty (n = 77, 26.1%), and breast interventions (n = 45, 15.2%). Complications related to the surgical event were hematoma (n = 14, 4.72%), anemia (n = 9, 3.04%), and wound dehiscence (n = 8, 2.70%); no ischemic or infection events were reported (Table 2).

Of the patients who underwent liposuction as the main procedure (n = 174), the only late postoperative complication was hematoma (n = 5, 2.87%). Regarding their recovery process using the hyperbaric chamber, it took a median of 1 day (IQR 3.25) to be able to brush their hair independently; a median of 2 days (IQR 6) to dress independently; a median of 3 days (IQR 1) to shower independently; an average of 8 days (IQR 7) to put on their shoes independently; and an average of 10 days (IQR 1) to return to work (Table 3).

Of the patients who underwent breast area interventions as the main procedure (n = 45), the only late postoperative complication was wound dehiscence (n = 3, 6.6%). Regarding their recovery process using the hyperbaric chamber, it took a median of 8 days (IQR 1) to be able to brush their hair independently; a median of 10 days (IQR 7) to dress independently; a median of 2 days (IQR 1) to shower independently, an average of 15 days (IQR 7) to put on their shoes independently; and an average of 3 days (IQR 5) to return to work (Table 4).

Of the patients who underwent abdominoplasty as the main procedure (n = 77), the immediate postoperative complication was anemia (n = 9, 11.6%), and late complications were hematoma (n = 9, 11.6%) and wound dehiscence (n = 5, 6.5%). Regarding their recovery process using the hyperbaric chamber, it took a median of 1 day (IQR 7) to be able to brush their hair independently; a median of 8 days (IQR 1) to dress independently; a median of 8 days (IQR 1) to shower independently; an average of 30 days (IQR 10) to put on their shoes independently; and an average of 21 days (IQR 7) to return to work (Table 5).

DISCUSSION

This article aimed to demonstrate the experience of using the hyperbaric chamber in the postoperative recovery process of aesthetic plastic surgery. Through this study, we were able to demonstrate the postoperative recovery time of patients using the hyperbaric chamber, identify

Table 1. Sociodemographic Characteristics

Characteristics	Measure of Central Tendency, n or %	Dispersion Measurement
Age, y	Median 33.5	IQR 11
Sex		
Male, %	94.6	NA
Female, %	5.4	
BMI, kg/m^2	Median 25.7	IQR 2.7

BMI, body mass index; IQR, interquartile range.

Table 2. Clinical and Surgical Characteristics

Variable	Measure of Central Tendency, n or %	Dispersion Measurement
Surgical procedures	n	NA
1	46	
2	146	
3	101	
4	3	
Surgical time	Median 240 min	IQR 70 min
Tranexamic acid IV	%	NA
Yes	97.6	
No	2.4	
Surgical intervention	n, %	NA
Liposuction	174, 58.7	
Breast surgery	68, 26.1	
Abdominoplasty	45, 5.2	
Complications	n, %	NA
Infection	0, 0	
Tissue ischemia	0, 0	
Hematoma	14, 4.72	
Wound dehiscence	9, 3.04	
Acute anemia	8, 2.70	

IQR, interquartile range.

Table 3. Liposuction Complications and Recovery Time

Variable	Measure of Central Tendency, n or %	Dispersion Measurement
Additional procedures	n, %	NA
0	1, 0.57	
1	107, 61.49	
2	64, 36.78	
3	2, 1.14	
Complications	n, %	NA
Infection	0, 0	
Tissue ischemia	0, 0	
Hematoma	5, 2.87	
Wound dehiscence	0, 0	
Acute anemia	0, 0	
Days to brush the hair independently	Median 1	IQR 3.25
Days to dressing independently	Median 2	IQR 6
Days to take a shower independently	Median 3	IQR 1
Days to put the shoes independently	Median 8	IQR 7
Days to get back to work	Median 10	IQR 1

IQR, interquartile range.

Table 4. Breast Surgery Complications and Recovery Time

Variable	Measure of Central Tendency, n or %	Dispersion Measurement
Additional procedures	n, %	NA
0	39, 86.66	
1	5, 11.11	
2	1, 2.2	
3	0, 0	
Complications	n, %	NA
Infection	0, 0	
Tissue ischemia	0, 0	
Hematoma	0, 0	
Wound dehiscence	3, 6.6	
Acute anemia	0, 0	
Days to brush the hair independently	Median 8	IQR 1
Days to dressing independently	Median: 10	IQR 7
Days to take a shower independently	Median 2	IQR 1
Days to put the shoes independently	Median 15	IQR 7
Days to get back to work	Median 3	IQR 5

IQR, interquartile range.

Table 5. Abdominoplasty Complications and Recovery Time

Variable	Measure of Central Tendency, n or %	Dispersion Measurement
Additional procedures	n, %	NA
0	4, 5.19	
1	36, 46.75	
2	36, 46.75	
3	1, 1.29	
Complications	n, %	NA
Infection	0, 0	
Tissue ischemia	0, 0	
Hematoma	9, 11.6	
Wound dehiscence	5, 6.5	
Acute anemia	9, 11.6	
Days to brush the hair independently	Median 1	IQR 7
Days to dressing independently	Median 8	IQR 1
Days to take a shower independently	Median 8	IQR 1
Days to put the shoes independently	Median 30	IQR 10
Days to get back to work	Median 21	IQR 7

IQR, interquartile range.

the various postsurgical complications experienced by this group of subjects, and indirectly show the role of the hyperbaric chamber in the entire process. We could not prove that the HBOT is effective for the postoperative process due to the methodological limitations, but we compared the results of this study to the information available online to establish the first step of a new research line that we are going to develop in this field.

The median age was 33.5 years, and most patients were women, which is consistent with data reported by the International Society of Aesthetic Plastic Surgery (ISAPS).[13] The complication rate in these patients was 10.7%, which is below the average complication rate for body contouring reported in the literature (11.17%).[14] Excluding anemia, which is not modifiable by the hyperbaric chamber, the incidence was 7.6%, demonstrating a notable reduction in postoperative complication occurrence when using the hyperbaric chamber compared with current evidence. Procedures such as liposuction and breast interventions reported complication rates of 2.87% and 6.6%, respectively, which are lower than those reported in the literature (8.3% and 6.6%, respectively).[14] The complication rate for abdominoplasty, excluding anemia, was 18.1%, which is comparable to the literature (18.8%).

It is noteworthy that there were no cases of surgical site infection in this study, which is a result of all aseptic processes and antibiotic prophylaxis protocols for surgical intervention,[15] and the use of postoperative hyperbaric chamber, which not only promotes tissue recovery but also controls and mitigates the development of surgical site infections, whether through oxygen free radicals, neovascularization, recruitment of defense cells, or synergy with antibiotics.[1]

The recovery time for patients undergoing hyperbaric chamber therapy after liposuction had a median return to work time of 10 days, which is lower than the recommendations by the American Society of Plastic Surgeons (ASPS), ISAPS, and Cleveland Clinic, which suggest returning to work after 2 postoperative weeks.[16–18] Patients undergoing breast interventions had a median return to work time of 3 days, which is also lower than the recommendations by the ASPS and the ISAPS, which suggest returning to work after a minimum of 5 days.[19,20] Finally, patients undergoing abdominoplasty took 21 days to return to work, which falls within the ranges (from 14 to 30 days) mentioned by the ASPS, the ISAPS, and The Aesthetic Society.[21–23] The recovery time wasn't shorter because, although the use of a postoperative hyperbaric chamber helps with wound healing, a major surgery like abdominoplasty requires a protocol that includes preoperative hyperbaric therapy sessions for optimal results. These preoperative sessions can aid in preparing and fortifying the tissues in the surgical area, as has been demonstrated in other surgical contexts[1] (Table 6).

Table 6. Other Surgical Outcomes

Main Intervention	Recovery Time with HBOT (Mean)	Literature Recomendation
Liposuction	10 d	ASPS 14 d
		ISAPS 14 d
		Cleveland Clinic 14 d
Breast augmentation	3 d	ASPS 5–7 d
		ISAPS 5–7 d
Abdominoplasty	21 d	ASPS 30 d
		ISAPS 14 d
		Aesthetic Society 14 d

However, it is important to acknowledge the limitations of this study. First, it is a retrospective study that demonstrates the experience of using the hyperbaric chamber in aesthetic plastic surgery practice but does not make comparisons between groups to demonstrate the effectiveness of its use for patient recovery. Second, as a retrospective study, it was not possible to delve into new variables of interest or conduct interviews or follow-up with patients.

In conclusion, this study demonstrated the experience of using postoperative hyperbaric chamber in aesthetic plastic surgery to promote recovery processes. The patient cohort in this study had recovery time to return to work after liposuction and breast interventions that seemed to be really quick. Also this patient cohort showed a low rate of complications, with no infections in this group. For major interventions, new hyperbaric oxygen protocols focused on rapid recovery specific to aesthetic plastic surgery are required.

Future studies are needed to validate the effectiveness of hyperbaric chamber use in aesthetic plastic surgery with protocols designed for this type of intervention. The aim is to gain a comprehensive understanding of HBOT pre- and postoperatively and how it could reduce complication rates and recovery times, making aesthetic surgery a safer and quicker medical practice.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. Shinomiya N, Asai Y. *Molecular Mechanisms and Clinical Applications Hyperbaric Oxygenation Therapy*. Vol. 1. Singapore: Springer; 2020.
2. Sander AL, Henrich D, Muth CM, et al. In vivo effect of hyperbaric oxygen on wound angiogenesis and epithelialization. *Wound Repair Regen*. 2009;17:179–184.
3. Kang TS, Gorti GK, Quan SY, et al. Effect of hyperbaric oxygen on the growth factor profile of fibroblasts. *Arch Facial Plast Surg*. 2004;6:31–35.
4. Myers RAM. Hyperbaric oxygen therapy for trauma: crush injury, compartment syndrome, and other acute traumatic peripheral ischemias. *Int Anesthesiol Clin*. 2000;38:139–151.
5. Thom SR. Oxidative stress is fundamental to hyperbaric oxygen therapy. *J Appl Physiol*. 2009;106:988–995.
6. Kirby JP, Snyder J, Schuerer DJ, et al. Essentials of hyperbaric oxygen therapy: 2019 review. *Mo Med*. 2019;116:176–179.

7. Friedman T, Menashe S, Landau G, et al. Hyperbaric oxygen preconditioning can reduce postabdominoplasty complications: a retrospective cohort study. *Plast Reconstr Surg Glob Open*. 2019;7:e2417.
8. Ríos-Gómez M, Gómez-Ortega V, Cardona C, et al. Hyperbaric oxygen therapy in plastic, aesthetic, and reconstructive surgery: systematic review. *Surg Tech Dev*. 2023;12:43–52.
9. Fan ZX, Gan Y, Qu Q, et al. The effect of hyperbaric oxygen therapy combined with hair transplantation surgery for the treatment of alopecia. *J Cosmet Dermatol*. 2021;20:917–921.
10. Liang J, Sun X, Yi L, et al. Effect of hyperbaric oxygen therapy on the survival rate of autologous fat transplantation. *Aesthetic Plast Surg*. 2023;47:423–429.
11. Yarar S, Arslan A, Ince B, et al. Histopathological evaluation of the effect of hyperbaric oxygen therapy on capsule occurrence around silicone breast prosthesis: an experimental study. *J Plast Surg Hand Surg*. 2021;55:118–122.
12. Nowikiewicz T, Szymankiewicz M, Zegarska B, et al. Clinical outcomes of hyperbaric oxygen therapy in treatment of postoperative chronic Pseudomonas aeruginosa wound infection following implant reconstruction of the breast. *Postepy Dermatol Alergol*. 2020;37:1009–1011.
13. International Society of Plastic Surgery (ISAPS). Plastic surgery statistics: global plastic surgery statistics for the year 2022. Available at www.isaps.org. Accessed June 2024.
14. Garoosi K, Mundra L, Jabbari K, et al. Comorbid conditions and complications in body contouring surgery: a retrospective review. *Aesthet Surg J Open Forum*. 2023;5:ojad080.
15. Ramon A, Correia N, Smati M, et al. Proposal of guidelines for antibiotic prophylaxis in plastic, reconstructive, and aesthetic surgery. *Ann Chir Plast Esthet*. 2020;65:13–23.
16. American Society of Plastic Surgeons. What you need to know about your liposuction recovery. Available at https://www.plasticsurgery.org/news/blog/what-you-need-to-know-about-your-liposuction-recovery. Accessed March 23, 2024.
17. The International Society of Aesthetic Plastic Surgery. Liposuction. Available at https://www.isaps.org/discover/patients-home/procedures/body-procedures/liposuction/. Accessed March 23, 2024.
18. The Cleveland Clinic. Liposuction: what it is, surgery, recovery & results. Available at https://my.clevelandclinic.org/health/treatments/11009-liposuction. Accessed March 23, 2024.
19. American Society of Plastic Surgeons. How long is the recovery for a breast augmentation?. Available at https://www.plasticsurgery.org/news/blog/how-long-is-the-recovery-for-a-breast-augmentation. Accessed March 23, 2024.
20. The International Society of Aesthetic Plastic Surgery. Breast augmentation. Available at: https://www.isaps.org/discover/patients-home/procedures/breast-procedures/breast-augmentation/. Accessed March 23, 2024.
21. American Society of Plastic Surgeons. What you need to know about your tummy tuck recovery. Available at https://www.plasticsurgery.org/news/blog/what-you-need-to-know-about-your-tummy-tuck-recovery. Accessed March 23, 2024.
22. The International Society of Aesthetic Plastic Surgery. Abdominoplasty. Available at https://www.isaps.org/discover/patients-home/procedures/body-procedures/abdominoplasty/. Accessed March 23, 2024.
23. The Aesthetic Society. Tummy tuck (abdominoplasty) recovery. Available at https://www.theaestheticsociety.org/procedures/body/tummy-tuck/aftercare-recovery. Accessed March 23, 2024.