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Revisiting Scalp Tissue Expander in Indonesia: Restoration of Cicatricial Alopecia

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ABSTRACT :

Background: Scalp alopecia from burn injuries significantly impacts physical appearance and psychological well-being, often leading to social phobia. Tissue expanders have been effective in reconstructive surgeries, offering advantages in restoring hair-bearing scalp areas with excellent color and texture match. However, comprehensive algorithms for their use, particularly in Indonesia, are lacking.

Case Presentation: A 10-year-old girl with cicatricial alopecia on the right lateral, frontal, and vertex of the scalp from a burn injury sought reconstructive surgery due to teasing from peers. A 400 mL round silicone expander was implanted and gradually expanded over five weeks. Reconstruction surgery advanced the expanded flap towards the frontal area, improving her hairline. Despite minor necrosis at the flap's distal margin, which healed by secondary intention, the outcome was favorable.

Discussion: This case demonstrates the effectiveness of tissue expanders in scalp reconstruction. Benefits include improved cosmetic outcomes and decreased donor site morbidity, though complications such as infection and alopecia in the expanded tissue require careful management. The underutilization of tissue expanders in Indonesia may be due to lack of insurance coverage and limited local availability.

Conclusion: Scalp tissue expansion is a beneficial technique for reconstructing scalp defects, especially in burn-induced alopecia. Wider adoption in regions with limited advanced modalities could significantly benefit patients.

KEYWORDS: scalp alopecia, burn injuries, tissue expanders, cicatricial alopecia, reconstructive surgery

INTRODUCTION

Scalp alopecia caused by burn injuries is a severe issue that not only affects the patient's physical appearance but also has psychological implications. This can lead to social phobia and severe trauma, causing patients to conceal their alopecia with hats, hairpieces, scarves, and/or wigs. Restoring scalp alopecia is crucial for both functional and cosmetic reasons, with the unique challenge of restoring hair-bearing skin.[1]

Tissue expander devices have been used in plastic and reconstructive surgeries for decades to stimulate the growth and expansion of various body tissues. As a crucial part of the soft tissue reconstructive ladder, the concept of tissue expander was described by Neumann in 1957 using rubber balloons to expand the skin for ear reconstruction and then perfected and popularized by Radovan in 1978.[2,3] Tissue expander has distinct advantages where each aesthetic subunit can be replaced with skin of identical or similar qualities using tissue expansion, and distant donor sites can be avoided. Sensate, hair-bearing skin such as the scalp can be expanded with excellent color and texture match.[4] Redistribution of hair follicles will occur naturally in expanded tissue, although no new follicle growth should be expected.[5]

The effectiveness of tissue expanders has been proven for decades. However, there is still currently a lack of a comprehensive and universal algorithm for the use of tissue expanders for scalp reconstruction. There is also currently a lack of published articles describing the use of tissue expanders especially for scalp burn injury reconstruction in Indonesia, where plastic surgeons much prefer the use of non-expanded flaps.[6,7]

CASE PRESENTATION

The patient, a 10-year-old girl, presented to the outpatient clinic of Setiabudi Hospital with cicatricial alopecia on the right lateral, frontal, and vertex of the scalp. The patient was injured due to hot water splashing accidentally on her head and face region 7 years

prior. The patient reported being teased by her peers due to alopecia, therefore seeking a reconstruction procedure to manage the burn scar. The patient did not have any other remarkable medical history. (Figure 1)

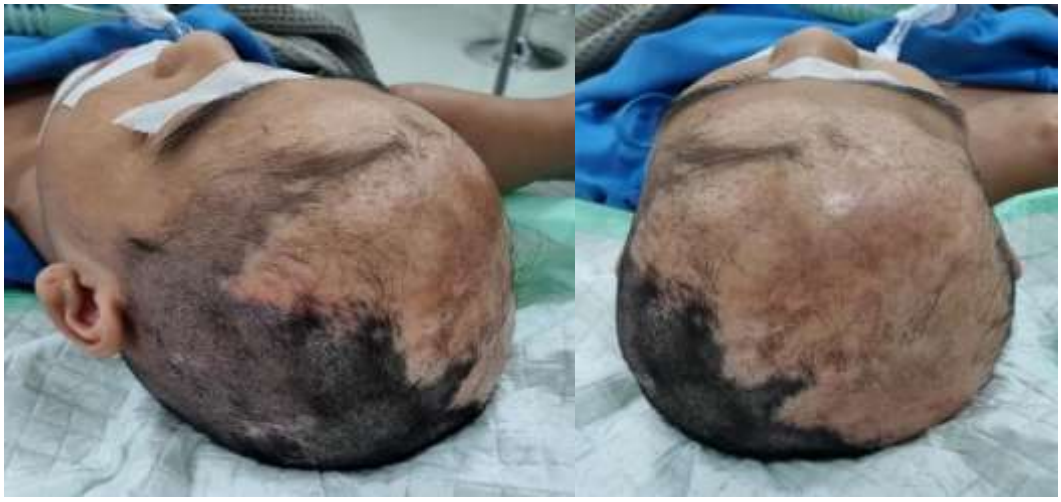

Figure 1. Patient's cicatricial alopecia due to thermal burn scarring.

Tissue expansion was done with a round 400 mL silicone expander with a 12,4 cm diameter base and 5 cm projection. A 10 cm incision was made on the frontotemporal hairline margin. The scalp was dissected to form a pocket roughly the size of the expander base and the tissue expander was inserted in the subgaleal layer. Upon insertion, 25 mL of normal saline was injected into the tissue expander via the injection port. After evaluating for any leak or malfunction, the incision was carefully closed with 4/0 non-absorbable monofilament sutures to avoid puncturing the tissue expander and the injection port. (Figure 2)

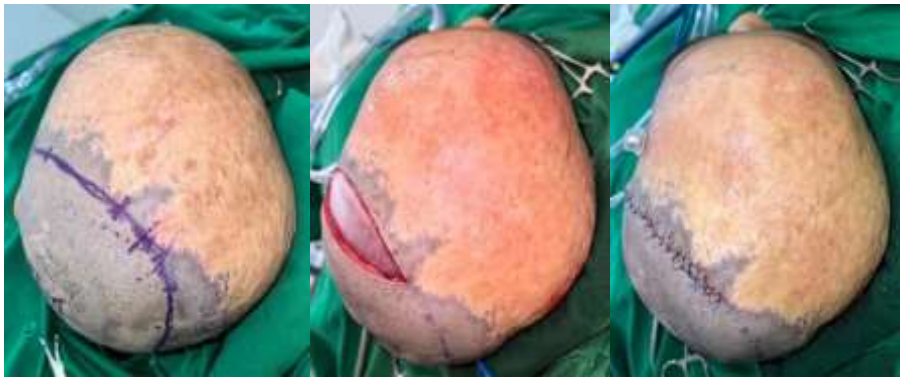

Figure 2. In-operation pictures of the design for dissection and incision (left), the insertion of tissue expander into the subgaleal layer (middle), and the sutured wound and injection port (right).

The patient was instructed to visit 2 times a week for wound evaluation. After three weeks, the site was deemed to be adequately healed to start filling the tissue expander. For each visit, normal saline ranging from 25 ml to 40 ml was injected into the injection port. These visits were also done two times a week and the volume reached its maximum goal (400 ml) in 10 visits spanning over 5 weeks. (Figure 3)

Figure 3. Gradual tissue expansion by injection of saline through the injection port, pictured at week 1 – 95 mL (left), week 3 – 255 mL (middle), and week 5 – 400mL (right)

The reconstruction surgery was done 10 days after the last visit. A design was made on the scalp to improve the frontal hairline and maximize tissue preservation. (Figure 4) The tissue expander was removed and the flap was advanced towards the frontal, measuring 7.5 cm at the greatest distance. (Figure 5) The flap was then sutured using a skin stapler with no tension. A drainage tube was inserted to prevent hematoma. (Figure 6) The wound was dressed with minimal pressure to prevent ischemic injury to the flap.

Figure 4. The incision is designed to follow along the hair-bearing scalp to preserve hair follicles.

Figure 5. The dissected flap (left) and the maximum achievable advancement, measuring 7.5 cm at the farthest distance (right)

Figure 6. The flap was sutured on the subcuticular layer using 4/0 absorbable poly filament sutures and closed with skin staples. A drainage tube is inserted to prevent hematoma.

On the 7-day evaluation, there was a necrotic area measuring around 5 cm by 1 cm at the distal margin of the flap (Figure 7). Along with the removal of skin staples on day 14, the necrotic tissues were debrided and dressed according to the moist wound principle. The wound healed by secondary intention without further complications. (Figure 8 & 9)

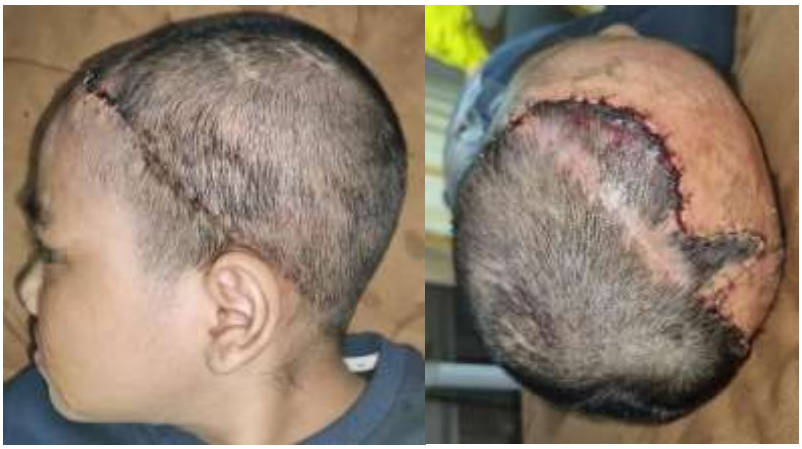

Figure 7. Evaluation on day 7 post-op: no signs of infection and wound dehiscence, however, there is a necrotic area on the frontal margin of the flap measuring around 5x1 cm (right).

Figure 8. The debrided necrotic tissue healed by secondary intention, picture taken on day-17 post-op

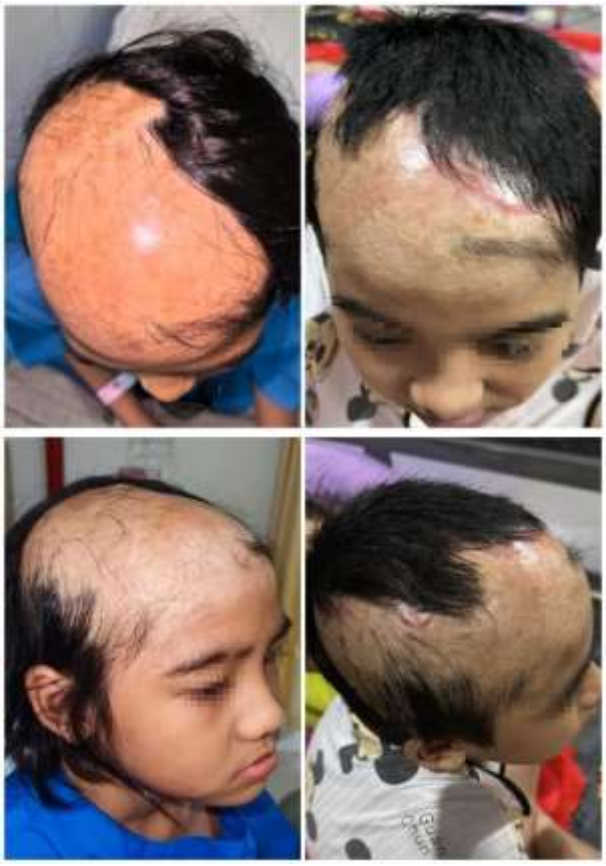

Figure 9. Comparison of before (left) and after (right) reconstruction procedure; pictures on the right taken 2 months after the last surgery.

DISCUSSION

A successful scalp reconstruction needs meticulous planning and understanding of the scalp anatomy. The integument structure of the scalp is the thickest in the human body, ranging from 3 to 8 mm thick, and as the name itself suggests, "SCALP" stands for Skin, subCutaneous tissue, galea Aponeurotica, Loose areolar tissue, and Pericranium.[8,9] The galea, an important part of scalp tissue expansion, is inelastic and causes tight and loose portions. It is fully formed from the scalp vertex, resulting in tight and inelastic skin. However, when galeal edges blend with temporoparietal fascia and scalp musculature fascia, skin mobility improves. The galea also fuses with the pericranium at the linea temporalis.[10] The current approach of subgaleal placement of the expander is deemed optimal, as the subgaleal layer is avascular and easy to undermine. Blood vessels, nerves, and lymphatic systems are located in the subcutaneous layer above the galea. If major vessels are isolated, an expander could be placed above the galea, potentially enhancing flap elasticity, but this approach has not been tested and may be timeconsuming.11,12

Tissue expander in the scalp has been deemed most likely to develop complications in general. Moreover, in cases of expansion due to burn scars, skin expansion along the already hypovascular cicatricial tissues could lead to an even larger decrease in blood supply, thus increasing the rate of complications including infection and necrosis. A more aggressive expansion might also be necessary given the low elasticity and high tension of cicatricial tissues, as well as the possibility of a "tissue stretch-back" phenomenon where expanded tissue contracts back after the tension is removed.[13,14] Tissue necrosis was present at the distal margin of the flap in the case presented. One hypothesis was that the distal part of the flap lacks appropriate vascularization further attributed by the scarring from the tissue expander insertion procedure proximal to the flap.

Tissue expansion is generally influenced by the shape of the tissue expander base. For instance, tissue area gains of 25%, 32%, and 38% are achieved by expanders with round bases, crescentic bases, and rectangular bases, respectively.[15] In the presented case, the farthest achievable length is 7.5 cm towards the apex of the head. In this instance, the amount of tissue gain is not sufficient to replace all cicatricial tissues. Therefore, to achieve a more significant and aesthetically pleasing result, a second or possibly third tissue expansion procedure was recommended.

With its various advantages, the lack of tissue expander usage in Indonesia is most possibly attributed to other factors such as the lack of social health insurance coverage, which the majority of patients seeking reconstruction utilize. There is also a noticeable lack of locally distributed tissue expander products at the time of the writing of this paper. Ultimately, we could not determine the causality of these factors due to their complexities. However, we aim to spark a wider interest in the use of tissue expanders in Indonesia especially in health facilities where more advanced modalities are limited, considering its position as one of the mainstays of the soft tissue reconstruction ladder.

CONCLUSION

Scalp tissue expansion is a useful technique for reconstructing defects in the scalp area. It offers several benefits such as improved cosmetic outcomes, decreased donor site morbidity, and the ability to provide adequate coverage for larger defects. This can be particularly advantageous in cases where there is a need for extensive scalp coverage where the elasticity of tissue is fairly low. However, there are also some potential pitfalls to be aware of when using scalp tissue expansion. These can include issues such as the risk of infection at the expander site, extrusion of the expander, and the possibility of alopecia in the expanded tissue. To mitigate these issues, careful patient selection, meticulous surgical technique, and close postoperative monitoring are essential. Additionally, educating patients about the potential complications and the need for adherence to postoperative care instructions is crucial for successful outcomes.

REFERENCES

1) Guzey, S., Alhan, D., Şahin, I., Aykan, A., Eski, M., & Nişancı, M. (2015). Our experiences on the reconstruction of lateral scalp burn alopecia with tissue expanders. Burns, 41(3), 631-637.
2) Neumann, C. G. (1957). The expansion of an area of skin by progressive distention of a subcutaneous balloon: Use of the method for securing skin for subtotal reconstruction of the ear. Plastic and Reconstructive Surgery, 19(2), 124-130.
3) Radovan, C. (1984). Tissue expansion in soft-tissue reconstruction. Plastic and Reconstructive Surgery, 74(4), 482-490.
4) Luthringer, M., Schultz, J., Gala, Z., Granick, M. S., & Keith, J. (2022). Scalp reconstruction. In Tips and Tricks in Plastic Surgery (pp. 313-325).
5) Prakash, V., Tandon, R., & Mantri, R. (2006). Supragaleal placement of tissue expander for post-burn alopecia. Journal of Plastic, Reconstructive & Aesthetic Surgery, 59(10), 1102-1104.
6) Pratama, Y. A., Saputro, I. D., & Aung, Z. M. (2023). Reconstruction of defects on post electric burn injury scalp with bone exposed: Case series. Biomolecular and Health Science Journal.
7) Prasetyo, A. T., Rizaliyanaa, S., & Saputro, I. D. (2018). Marjolin's ulcer: Malignant transformation from burn scar. Jurnal Rekonstruksi & Estetik, 3(1).
8) Freund, R. M. (1997). Scalp, calvarium and forehead reconstruction. In S. J. Aston, R. W. Beasley, & C. H. M. Thorne (Eds.), Grabb and Smith's Plastic Surgery (pp. 473). Philadelphia, PA: Lippincott-Raven.

9) Shestak, K. C., & Ramasastry, S. S. (1994). Reconstruction of defects of the scalp and skull. In M. Cohen (Ed.), Mastery of Plastic and Reconstructive Surgery (pp. 830-841). Boston, MA: Little, Brown.
10) Moss, C. J., Mendelson, B. C., & Taylor, G. I. (2000). Surgical anatomy of the ligamentous attachments in the temple and periorbital regions. Plastic and Reconstructive Surgery, 105(4), 1475-1490.
11) Raposio, E. (2018). Scalp expansion: Surgical considerations and possible future directions. Indian Journal of Plastic Surgery, 51(1), 84-88.
12) Desai, S. C., Sand, J. P., Sharon, J. D., Branham, G., & Nussenbaum, B. (2015). Scalp reconstruction: An algorithmic approach and systematic review. JAMA Facial Plastic Surgery, 17, 56-66.
13) Azzi, J. L., Thabet, C., Azzi, A. J., & Gilardino, M. S. (2020). Complications of tissue expansion in the head and neck. Head & Neck, 42(4), 747-762.
14) Neale, H. W., High, R. M., Billmire, D. A., Carey, J. P., Smith, D., & Warden, G. (1988). Complications of controlled tissue expansion in the pediatric burn patient. Plastic and Reconstructive Surgery, 82, 840-848.
15) Nordström, R. E. (Ed.). (1996). Tissue expansion. Boston, MA: Butterworth-Heinemann. Scalp; pp. 107–123. Review of indications, results and outcome during 15 years' experience. Burns, 45(4), 990-1004.