

A Novel Technique of Total Scrotal Resurfacing with NovoSorb Biodegradable Temporizing Matrix for Testicular Preservation

Jake Chia, BMedSc (Sydney),
MBBS, MS

Elle Vandervord, MBBS

Maryam Seyedabadi, BSci (Hons
1), BDS, MBBS, PhD (Medicine),
FRACS (PLAST)

Summary: The reconstruction choice of scrotal defects after Fournier gangrene has been routinely based on the reconstructive ladder. Defects are usually managed with either skin-grafting or regional flaps to achieve testicular coverage. However, skin grafting done directly to testes may lead to chronic pain issues, and skin flaps can potentially be too thick to achieve good temperature control for spermatogenesis. We present the first reported case of total scrotal resurfacing after Fournier gangrene in a 48-year-old patient with NovoSorb Biodegradable Temporizing Matrix. The patient showed a good cosmetic outcome with no residual pain issues. Further research is recommended to further investigate the long-term effects of scrotal reconstruction with Biodegradable Temporizing Matrix. (*Plast Reconstr Surg Glob Open* 2024; 12:e5726; doi: [10.1097/GOX.00000000000005726](https://doi.org/10.1097/GOX.00000000000005726); Published online 8 April 2024.)

Scrotal reconstruction has been traditionally achieved with skin grafting techniques before the discovery of perforator-based thigh flaps and is often done directly onto bare testes after soft tissue loss from necrotizing skin infections. Some surgeons have buried the exposed testes into thigh pouches to allow for a more uniform wound bed for skin grafting. However, burying the testes can result in poorer fertility and body image outcomes.¹ Several skin flap designs have been reported to create a neoscrotum to house the exposed testes.²⁻⁴ However, they can be significantly bulky and less aesthetically pleasing if the patient is overweight. Testicular temperature regulation may also be affected if the soft tissue is too thick.⁵ The advances in tissue bioengineering have made it possible to reconstruct complex wounds with tissue substitute adjuncts.⁶ We present the first reported case of a novel total and penile shaft scrotal reconstruction with NovoSorb Biodegradable Temporizing Matrix (BTM) (PolyNovo Biomaterials Pty Ltd, Port Melbourne, VIC, Australia) on a 48-year-old patient after a severe life-threatening case of Fournier gangrene.

CASE REPORT

A 48-year-old man initially presented with sepsis from a testicular source. His lactate on presentation was 6.9 with

a white cell count of 9.7 and a C-reactive protein of 304. Further testing revealed a significantly elevated procalcitonin level of 406, suggesting a bacterial sepsis. Shortly after arrival, he went into pulseless electrical activity cardiac arrest despite aggressive resuscitation with broad-spectrum antibiotics. Return of spontaneous circulation was achieved and he was promptly brought to theaters for urgent debridement by the urology team and subsequently admitted to the ICU for high vasopressor support. He had a history of poorly controlled type 2 diabetes, coronary artery disease, and a casual smoking history.

Tissue samples from serial debridement had grown *Streptococcus pyogenes*. Our team was subsequently presented with the challenge of reconstructing his defect with complete circumferential soft tissue loss around the penile shaft and both testes with exposed tunica albuginea (Fig. 1). Unfortunately, the resultant wound bed had minimal granulation tissue around both testes and the penile shaft to be reconstructed with a skin graft. The patient's preference for not having the testes buried for body image issues and temperature regulation for fertility were considered. After laparoscopic diverting loop sigmoid colostomy to prevent fecal soiling of the wound bed, we performed a novel reconstruction with complete scrotal resurfacing using a synthetic BTM to avoid the need to bury the exposed testes in a thigh pouch (Fig. 2). (See figure, Supplemental Digital Content 1, which shows the templating of the BTM mold and the application of the

From Department of Plastic and Reconstructive Surgery, Westmead Hospital, Sydney, Australia.

Received for publication December 12, 2023; accepted February 20, 2024.

Copyright © 2024 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.
DOI: [10.1097/GOX.00000000000005726](https://doi.org/10.1097/GOX.00000000000005726)

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.



Fig. 1. Photograph of defect with complete scrotal and circumferential penile shaft soft tissue loss.



Fig. 2. Application of BTM to scrotal and penile defect.

BTM to the wound bed. <http://links.lww.com/PRSGO/D140>.) A vacuum-assisted closure (VAC) device was placed over the BTM to assist in integration of the matrix into the soft tissue by shaping the VAC foam to form a cradle for the neoscrotum, and the shaft was dressed in handheld traction. His first dressing change after 7 days revealed complete matrix adherence to the wound bed with no signs of residual infection.



Fig. 3. Split skin grafting of delaminated BTM on scrotum and penile shaft.

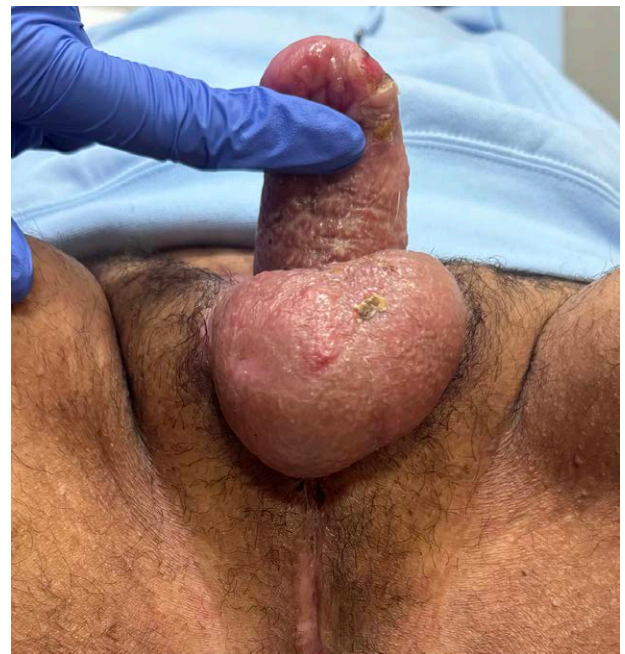


Fig. 4. Mature skin graft on neoscrotum and penile shaft with good cosmetic results.

The polyurethane sealing membrane on the BTM was delaminated at week 6 after application; the neodermis was grafted with a split-thickness skin graft (Fig. 3) and dressed with a VAC. Complete graft-take was seen after 7 days. Figure 4 demonstrates a mature graft at 12 weeks

after the initial application of the BTM. Although he developed traumatic hypospadias due to traction injury from the long-term catheter, the patient was not bothered by it and was referred to a urologist for repair. The final reconstructive result had a good cosmetic outcome and the patient was able to achieve an erection without pain.

DISCUSSION

When faced with the challenge of reconstructing a scrotal defect, we must consider the defect size, tissue availability, patient preferences, and long-term sequelae of our reconstruction options. Current literature has suggested various techniques to reconstruct the scrotum based on the basic plastic surgery principle of the reconstructive ladder.¹ In extreme cases, orchidectomy and secondary wound closure have been reported to achieve tissue coverage, as described by Bhatnagar and his group in 2008.⁷ However, they also noted that orchidectomy and thigh pouches should be avoided in young patients due to cosmetic and fertility implications.

Flap coverage remains the mainstay of scrotal reconstruction based on the systematic review conducted by Karian et al with a pooled patient number of 128 (30.1%), followed by split-thickness skin grafting with a total of 96 patients (22.6%) out of 16 included studies.¹ Split skin grafting can potentially lead to chronic pain issues. Akilov et al described a patient who eventually required ipsilateral orchidectomy due to chronic pain after a split skin graft reconstruction on his testes.⁸ Conversely, skin flaps and thigh pouches can also disrupt the temperature regulation of testes, resulting in impaired spermatogenesis. Wang et al reported that a temperature of 2–8°C lower than the body's core temperature is required for healthy spermatogenesis.⁵ As such, temperatures of scrotal reconstruction with thick flaps are likely to be higher than this requirement.

Other bovine dermal matrices have been used previously to reconstruct partial scrotal defects.⁹ However, these matrices are of biological origin and may be susceptible to higher infection risks. In comparison, BTM is purely made of synthetic biodegradable polyurethane that is nonpyogenic.^{10,11} The resultant BTM neodermis can also prevent secondary contractures caused by split skin grafts, as seen in complex burn wounds.¹²

Through our experience, we believe that a long-term catheter is usually not required after the BTM has initially integrated into the wound bed, and the patient can be transitioned to simple dressings from VAC dressings at week 2 after application. This will reduce the risk of developing traumatic hypospadias from long-term catheter use.

CONCLUSIONS

BTM is a safe and effective alternative scrotal reconstructive option that can provide good cosmesis and avoid temperature regulation issues that may affect spermatogenesis even in large tissue defects involving the entire scrotum.

Further research looking at long-term spermiogenesis and testosterone level is recommended on the use of newer synthetic biodegradable matrices, like BTM in our case, for complex reconstruction after Fournier gangrene, to quantify the functional outcomes of synthetic scrotal reconstructions objectively.

Jake Chia, BMedSc (Sydney), MBBS, MS

Department of Plastic and Reconstructive Surgery

Westmead Hospital, Sydney

Australia

E-mail: drjakechia@gmail.com

DISCLOSURES

Only the publication cost to allow for open access to this article is funded by PolyNovo Biomaterials Pty Ltd, Port Melbourne, VIC, Australia. All procedure and material costs are not sponsored by PolyNovo Biomaterials Pty Ltd. The authors have no other financial interest or shares in PolyNovo or the use of BTM.

ACKNOWLEDGMENT

All surgeries and procedures performed in this study conform to all guidelines of the Declaration of Helsinki.

REFERENCES

1. Karian LS, Chung SY, Lee ES. Reconstruction of defects after Fournier gangrene: a systematic review. *Eplasty*. 2015;15:18.
2. Patil A, Yelikar A, Vichare A, et al. Reconstruction of scrotum with anteromedial thigh flap. *MGM J Med Sci*. 2019;6:165–170.
3. Kashiyama K, Nakano M, Higashi A, et al. Reconstruction of a scrotum by combining two skin flaps in a ball shape. *Case Rep Urology*. 2022;2022:2808821.
4. Karaçıl N, Livaoglu M, Kutlu N, et al. Scrotum reconstruction with neurovascular pedicled pudendal thigh flaps. *Urology*. 2007;70:170–172.
5. Wang D, Zheng H, Deng F. Spermatogenesis after scrotal reconstruction. *Br J Plast Surg*. 2003;56:484–488.
6. Ferraro GA, Lanzano G, Grella E, et al. Successful treatment of wound dehiscence by innovative type 1 collagen flowable gel: a case report. *Plast Reconstr Surg Glob Open*. 2022;10:e4360.
7. Bhatnagar AM, Mohite PN, Suthar M. Fournier's gangrene: a review of 110 cases for aetiology, predisposing conditions, microorganisms, and modalities for coverage of necrosed scrotum with bare testes. *N Z Med J*. 2008;121:46–56.
8. Akilov O, Pompeo A, Sehr D, et al. Early scrotal approximation after hemiscrotectomy in patients with Fournier's gangrene prevents scrotal reconstruction with skin graft. *Can Urolog Assoc J*. 2013;7:481–485.
9. Barham DW, Lee MY, Stackhouse DA. Novel scrotal reconstruction after Fournier's gangrene using the Integra dermal regeneration template. *Urology (Ridgewood, N.J.)*. 2019;128:3–4.
10. Greenwood JE, Dearman BL. Comparison of a sealed, polymer foam biodegradable temporising matrix against Integra dermal regeneration template in a porcine wound model. *J Burn Care Res*. 2012;33:163–173.
11. Wagstaff MJD, Salna IM, Caplash Y, et al. Biodegradable Temporising Matrix (BTM) for the reconstruction of defects following serial debridement for necrotising fasciitis: a case series. *Burns Open*. 2019;3:12–30.
12. Greenwood JE, Schmitt BJ, Wagstaff MJ. Experience with a synthetic bilayer biodegradable temporising matrix in significant burn injury. *Burns Open*. 2018;2:17–34.