

ORIGINAL RESEARCH

Surgical complications and subsequent revision surgeries among noma cases treated in Ethiopia

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Email: gezahegn.heron@gmail.com**Abstract**

Introduction: Noma, an overlooked infectious disease, inflicts severe facial tissue damage, posing substantial challenges in patient care. This study delves into surgical complications and subsequent revision surgeries among noma cases treated in Ethiopia.

Materials and Methods: The research employed a cross-sectional retrospective review of medical records treated between 2007 and 2019 retrieved from the Facing Africa database.

Results: The review encompasses 235 noma cases. Twenty-four cases (19 females and 5 males) experienced various complications, predominately major complications leading to subsequent revision surgeries. The identified complications included flap necrosis, abscess formation, tenderness, graft site infection, flap bulking, dental misalignment, corner of the mouth dehiscence, infected bone and plate, flap malpositioning, restricted mouth opening with ankylosis, neuropathic pain, recurrent flap infection, and offensive odor. Revision surgeries included wound cleansing, abscess drainage, skin graft removal, exploratory surgery, wound care, debulking, scar removal, debridement, trismus release, commisuroplasty, and flap repositioning.

Conclusion: These findings illuminate the intricacies of noma surgery in Ethiopia, emphasizing the importance of understanding the nature and frequency of complications for optimizing treatment outcomes. Insights from this study can guide health-care providers, especially novice surgeons, and policymakers, in refining surgical interventions and enhancing outcomes for noma patients. Improved knowledge in this realm is crucial for advancing patient care and developing targeted interventions.

Level of Evidence: 5.

KEYWORDS

medical charts, noma, retrospective analysis, revision surgeries, surgical complications

1 | INTRODUCTION

Noma, also known as cancrum oris, is a devastating infectious disease primarily affecting individuals living in poverty, particularly children

with compromised immune systems.¹ If left untreated, it leads to severe facial tissue destruction and significant morbidity and mortality.² Reconstructive surgery is crucial in restoring functional and aesthetic outcomes for noma-affected individuals.³ The goal of advanced

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surgical treatment is to restore functional abilities and aesthetic harmony, thereby improving the patient's quality of life by enabling effective speech, breathing, chewing, interaction, work, and communication.⁴ In the early stage of the disease, minor surgical interventions can be employed to save lives and contain the spread of the disease.⁵⁻⁸ However, complex reconstructive surgery is typically required for arrested noma. Correcting deformities resulting from noma presents significant challenges for plastic and reconstructive surgeons due to the various types of disfigurement it causes in children and young adults.⁶ Each case requires a unique surgical strategy, as no standardized procedure exists.⁹

Reconstructive surgery is seldom considered unless the sequelae hinder adequate nutrition and respiration, primarily because most noma patients reside in impoverished countries with limited access to continuous medical care.⁷ Local physicians are advised to perform surgical treatment in mild cases that do not require advanced surgical facility. For severe cases, seeking treatment abroad where adequate surgical facilities are available or participating in medical mission campaigns led by surgeons with access to sophisticated resources is recommended. This approach ensures satisfactory outcomes while minimizing the risk of severe and potentially life-threatening complications.^{4,8,9} The appropriate treatment approach is typically determined by an experienced surgical team in consultation with the patient, taking into account factors such as photographs, mouth opening, age, general condition, and concurrent diseases.¹⁰ An initial evaluation involves a comprehensive clinical and, if necessary, radiological examination to assess the extent of disfigurement, loss of bone and soft tissue, dental health, and degree of mouth narrowing. A detailed action plan outlining the sequence of procedures, intubation requirements, and other relevant considerations should be devised by the surgical team. Most surgical operations usually require General anesthesia and intubation.¹¹ In cases of jaw stiffness, fibroscopic intranasal intubation can be used to avoid tracheostomy. Special planning and care are essential for noma patients, considering a significant proportion of them are children.¹²

Various surgical techniques have been reported to address a range of noma defects. These include pedicled supraclavicular flaps for large unilateral facial defects, Abbe, Estlander, and Fan flaps for lip and corner-of-the-mouth reconstruction, frontal, deltopectoral, radial forearm, and free flaps for cheek reconstruction, and Abbe, radial forearm, free, medial forehead, and local envelope flaps for central defect reconstruction involving the upper lip and nose. In some cases, improving mouth opening may involve bone bridge excision, sometimes accompanied by contralateral coronoidectomy.¹³ However, surgical interventions are not without risks; complications can arise during or after the procedure.¹⁴ Understanding these potential complications is crucial for healthcare professionals managing noma cases.^{4,9} Unfortunately, there is limited data on specific surgical complications and subsequent revision surgeries needed to treat noma patients.¹⁵ This knowledge gap hinders the ability to provide targeted interventions and optimize treatment outcomes. To address this gap, this study aimed to conduct a comprehensive electronic retrospective review of medical charts from the

Facing Africa database. By analyzing the available data, the study targeted to identify and document possible surgical complications and subsequent revision surgeries encountered in surgically treated noma cases in Ethiopia between 2007 and 2019. The findings of this study are anticipated to contribute to the existing knowledge on surgical complications and subsequent revision surgeries among surgically treated noma cases. The findings can also inform the development of training programs and guidelines to improve the surgical management of noma and enhance overall patient outcomes.

2 | MATERIALS AND METHODS

The current study aimed to identify possible surgical complications and subsequent revision surgeries carried out among surgically treated noma cases in Ethiopia through a comprehensive electronic retrospective review of medical charts.

3 | STUDY DESIGN

This study employed a retrospective research design to identify possible surgical complications and subsequent revision surgeries among surgically treated noma cases in Ethiopia. A comprehensive electronic retrospective review of medical charts from the Facing Africa database was conducted.

3.1 | Data source

The primary data source for this study was the Facing Africa database, which contains a substantial collection of medical records from noma patients who have undergone surgical interventions in Ethiopia.

3.2 | Sample selection

The study reviewed all the medical records of surgically treated noma cases between 2007 and 2019. The sample size was determined based on the availability of relevant medical records and the feasibility of data extraction within the study's timeframe.

3.3 | Data collection

The data collection process involved a systematic review of electronic medical charts from the Facing Africa database. A standardized data collection form was developed to capture relevant information, including patient demographics, surgical procedures performed, documented surgical complications, and subsequent revision surgeries. The data collector ensured consistency and accuracy in data extraction.

3.4 | Data analysis

The data analysis involved employing descriptive statistics to examine the collected data. This included describing the frequency and percentage of each surgical complication, and subsequent revision surgeries reported. Reported complications are classified into minor and major complications based on the Accordion Severity Grading System for postoperative complications. Accordingly, complications requiring repeat surgery under local or general anesthesia are categorized as major. In contrast, complications that are treated with antibiotics, physiotherapy, or wound care are categorized as minor. The outcomes were then presented in both tabular and textual formats, aiming to offer a comprehensive summary of the various types of surgical complications encountered in noma cases within Ethiopia.

3.5 | Ethical Consideration

Ethical approval was obtained from the Institutional Review Boards of the Addis Ababa Health Bureau. The declaration of approval number is 'A/A/H/B/2116/227'. Informed consent was obtained from all study participants and/or their legal guardians, who agreed to the use of their medical records for research purposes, to ensure compliance with ethical standards. The confidentiality and protection of the patients' data were strictly maintained throughout the entire study. To ensure privacy, personal identifiers were anonymized. In addition, to minimize data collection errors, standardized data collection forms were used.

4 | RESULTS

Varying types of reconstructive surgical procedures, including submental flap, ankylosis release, commissuroplasty, coronoidectomy, and Estlander flap, were applied to treat 235 noma cases in Ethiopia under Facing Africa between 2007 and 2019. Overall, 24 (19 females and 5 males) surgically treated noma cases were found to have varying kinds and degrees of postoperative complications. Of these, nine and eight cases presented with right- and left-sided noma, respectively. The remaining seven cases presented with central noma. With the exception of one complication, which turned out to be minor, all other complications were major and required revision surgery. The table below presents the findings from a retrospective analysis of 235 medical records of noma cases in Ethiopia (Table 1), focusing on surgical complications associated with noma surgery.

The complications observed in the study varied in nature and affected different areas of the face. Some common complications included necrosis (tissue death), abscess formation, inflammation, tenderness, infection, bulking (excessive tissue growth), difficulty of mouth opening, abscess formation, and dehiscence (wound opening). These complications occurred in patients of various ages, ranging from 8 to 66 years old.

The initial treatments received by the patients varied based on the specific defects and areas affected by noma. These treatments included nose reconstruction, lip reconstruction, facial reconstruction, skin grafting, and multiple other surgical procedures involving different types of flaps. However, despite these initial interventions, complications arose in these cases. Additional interventions (revision surgeries) aimed at resolving the specific issues encountered in each case, such as infection control, tissue repair, and restoring proper function and aesthetics, were undertaken to address the complications. These included procedures such as abscess drainage, wound cleaning and debridement, removal of infected bone and plate, commisuroplasty (surgical repair of the corner of the mouth), flap debulking (reducing excessive tissue growth), scar release, and necrotectomies (removal of necrotic tissue) (Table 1).

5 | DISCUSSION

Reconstructive surgery is vital in treating noma patients, aiming to remove scar tissue and restore tissue defects using well-vascularized tissue.¹⁶ However, assessing the effectiveness of noma treatment is challenging due to inconsistent patient follow-up and limited access to patients in isolated home villages.¹⁶⁻¹⁸ Studies by Bouman et al. reported a complication rate of 64% in reconstructive noma surgery, with only 14 out of 36 complex procedures achieving a good outcome. Minor complications included superficial wound infections and minor dehiscence, while moderate complications often involved deep wound infections leading to partial or complete flap loss. Complex reconstructions and patients with complete trismus had less favorable outcomes.¹⁹ Various scholars have also reported complications such as superficial infection, abscess formation, flap failure, flap necrosis, flap detachment, graft site infection, and dehiscence of the corner of the mouth associated with noma reconstructive surgery.¹⁹⁻²¹ Complications can be classified into short-term and long-term categories. Short-term complications include partial flap necrosis, complete flap loss and necrosis, bleeding/hematoma, donor site dehiscence, and recurrent fistulae.²² Bisseling et al. found that long-term outcomes of trismus release surgery in 36 patients showed that 22% experienced difficulty eating and 14% had trouble speaking.⁹ Honeyman et al. reported 15 long-term complications, including chronic fistula, chronic infection, chronic pain, keloid scarring, wound breakdown, and exposed metalwork, with 30% of the population experiencing long-term complications.²³

Noma can result in various sequela, including trismus, sequestration of the jaws, fibrous ankylosis of the temporomandibular joint, oro-nasal fistula, damage to permanent tooth buds, premature loss of deciduous teeth, and maxilla and mandible hypoplasia.^{9,24,25} Soft and hard tissue loss often leads to chewing difficulties for noma patients.²⁶ While the surgical intervention for noma patients is primarily focused on treating the sequelae, it is important to note that complications can arise in certain cases.²⁷⁻²⁹ A systematic review of reconstructive surgery for noma patients found that the most

TABLE 1 Outlines surgical complications and revision surgeries in surgically treated Noma cases in Ethiopia, providing details on diagnosis, affected facial tissue, complications, gender, age at surgery, initial treatment, and subsequent revision interventions.

Diagnosis and affected facial tissue	Complications	Classification of complications (minor or major)	Delayed flap failure due to delayed infection (delayed flap failure is defined as flap loss after the seventh postoperative day (POD))	Gender of the cases with complications	Age (at the time of surgery) of the case with the complication	Initial surgical treatment received	Revision interventions (surgeries or/and antibiotics or/and wound care)
Central noma involving the nose	Necrosis to the right cheek and abscess to the left side of the chin	Major	No	F	66	Nose reconstruction (Columella reconstruction)	Opened and cleaned out and then closed
Right noma involving cheek, nose, inferior border of the eye, upper and lower lips	Inflammation and tenderness to palpation over the tip of the nose; pus collection lateral to nasal reconstruction	Major	No	F	19	Reconstruction of the right face (cheek, nose, inferior border of the eye, upper and lower lips)	Abscess drainage under GA and antibiotics
Left noma involving cheek, nose, inferior border of the eye, upper and lower lips	Back graft site infection and disorientation of lower teeth that projected into the lower lip	Major	Yes	M	25	Reconstruction of the left face (cheek, nose, inferior border of the eye, and upper and lower lips)	Skin graft removed and wound edges trimmed, cleaned, debrided and later skin grafted
Left Noma involving cheek and lips	1 cm dehiscence of the corner of the mouth and abscess under the chin as a result of stitch reaction	Major	Yes	F	8	Reconstruction of the left face (cheek, lip)	Exploratory surgery for the abscess under the chin and wound care
Central Noma involving upper lip, nose, and central maxilla	Bulking (excessive flap, infected bone and plate, and mal-positioned flap on the nose); a very bulky flap to the nasal area causing no breathing hole that results in inability to breathe through the nose	Major	Yes	M	33	Reconstruction of the upper lip with a radial forearm flap, and reconstruction of the nose with a scapula flap	Removal of infected bone and plate, debulking and repositioning of the flap to recreate upper lip and uncover nasal aperture
Left noma involving cheek, lips, and oral commissure	Decreased mouth opening with ankylosis after multiple surgeries (ankylosis releases with	Major	No	F	18	Multiple surgeries (ankylosis releases with coronoidectomy)	Release of scar+ commissuroplasty +flap debulking

TABLE 1 (Continued)

Diagnosis and affected facial tissue	Complications	Classification of complications (minor or major)	Delayed flap failure due to delayed infection (delayed flap failure is defined as flap loss after the seventh postoperative day (POD))	Gender of the cases with complications	Age (at the time of surgery) of the case with the complication	Initial surgical treatment received	Revision interventions (surgeries or/and antibiotics or/and wound care)
	<p>coronoidectomy); and twitching over left cheek and sharp neuropathic type pain; difficulties of eating, drinking, and speaking</p>						
Right noma involving the corner of the mouth	Bulking	Major	No	F	17	Reconstruction with submental flap	Debulking of submental flap and commissuroplasty
Right noma involving the corner of the mouth (oral commissure)	Necrosis of the distal part of the PTF (making the inner lining corner mouth)	Major	Yes	F	16	Reconstruction of noma-associated defect on the right corner of the mouth	Several necrotectomies done
Right noma involving the upper lip and teeth	Recurrent infection in flap (flap again appears distended with pus coming out but patient well); edge necrosis found on right of flap (up to the edge of mouth)	Major	Yes	F	39	Submental flap, dental extractions	Area debrided, plan to leave open for secondary healing (twice daily cleaning and dry dressing)
Right noma involving the nose and upper lip	Blackened upper lip, offensive and foul odor, dehiscence mouth/lip, pain	Major	Yes	F	40	Facial reconstruction with submental flap	Surgical debridement under LA
Left noma involving the corner of the mouth and the upper and lower lips	Edge necrosis on lower area of flap	Major	Yes	F	17	Submental flap, dental extractions and soft tissue trismus release with bilateral coronoidectomies	Area debrided, packed with wet dry gauze (for twice daily dressings), and reoperated under local anesthesia
Central noma involving the nose	Nasal graft necrosis	Major	Yes	F	28	Nasal reconstruction with costochondral graft and left lower eyelid reconstruction	Necrotic tissue debridement under GA

(Continues)

TABLE 1 (Continued)

Diagnosis and affected facial tissue	Complications	Classification of complications (minor or major)	Delayed flap failure due to delayed infection (delayed flap failure is defined as flap loss after the seventh postoperative day (POD))	Gender of the cases with complications	Age (at the time of surgery) of the case with the complication	Initial surgical treatment received	Revision interventions (surgeries or/and antibiotics or/and wound care)
Left noma involving the teeth, cheek, corner of the mouth, and lips	Difficulty of mouth opening, 1 cm dehiscence of the corner of the mouth, dental abscess, and excessive flap	Major	No	F	13	NOMA Stage 3 reconstruction- Commissuroplasty and ALT flap	Excision of the dental abscess, bilateral coronoidectomies and debulking of flap, secondary intention to dehiscence
Right noma (Montandon Type IV)	Flap necrosis and subsequent infection on upper lip	Major	Yes	F	20	Reconstruction with a radial forearm free flap	Upper right lip reconstruction with Abbe flap
Right noma (Montandon Type IV)	Sialocele and salivary fistula	Major	No	M	46	Scar excision, removal of teeth and reconstruction with left radial forearm free flap	Serial aspirations and hyoscine; reconstruction with an antero-lateral thigh free flap
Central noma involving the nose	Nasal graft displacement	Major	No	F	30	Reconstruction with radial forearm flap	Nasal reconstruction (graft repositioning)
Central noma with left-side major defect involving the cheek, upper and lower lips, ala of the nose, and the eye	Difficulty of closing mouth and drooling; narrowing of left nostril		No	F	27	Facial reconstruction with local flaps	Reconstruction of the left side of the face including the nose with submental flap; commissuroplasty
Left noma involving the cheek, lips, corner of the mouth, teeth, the eye	Infection of the reconstructed inferior orbit	Major	Yes	F	14	Reconstruction of the left face with radial flap; bilateral ankylosis release; reconstruction of new inferior orbit with coronoids	Exploration of bone graft and debridement
Right noma involving the cheek, lips	Excessive flap-induced difficulty in eating, drinking, and speaking	Major	No	F	29	Scar release and submental flap reconstruction	Reduction of the flap, revision scar release (right cheek), and commissuroplasty
Left noma involving cheek	Fistulas on the medial side of the flap	Major	Yes	M	16	Reconstruction with anterolateral thigh (ALT) flap	Fistulotomy

TABLE 1 (Continued)

Diagnosis and affected facial tissue	Complications	Classification of complications (minor or major)	Delayed flap failure due to delayed infection (delayed flap failure is defined as flap loss after the seventh postoperative day (POD))	Gender of the cases with complications	Age (at the time of surgery) of the case with the complication	Initial surgical treatment received	Revision interventions (surgeries or/and antibiotics or/and wound care)
Central noma involving the lower lip	Loss of skin graft lower lip	Major	Yes	F	30	Fujimori Gate flap lower lip reconstruction	Skin graft reconstruction
Left noma involving the teeth, cheek, lips, corner of the mouth	Ankylosis of the jaw causing difficulties in eating and drinking; superficial dehiscence of free flap	Major	No	M	25	Release of fibrous trismus with repair of intraoral defect with left radial forearm free flap	Debridement and trismus release
Right noma involving the upper lip	Drooling of saliva and mild difficulty of mouth opening	Minor	No	F	21	Reconstruction of the upper lip with submental flap and Estlander flap	Physiotherapy
Central noma involving the upper and lower lips, the maxilla and mandible, the nose, the right eye, the bilateral cheek	Bulking of flap around the cheeks and oral cavity; very small mouth aperture; considerable ectropion around the left eye	Major	Yes	F	30	Perioral/facial reconstruction with para-scapular flap, ectropion repair, left lower eyelid reconstruction, and nasal reconstruction with a costochondral graft	Necrotic tissue debridement, debulking, ectropion repair, and commisuroplasty



FIGURE 1 Depicts a 14-year-old female noma case who presented with postoperative infection of the left side inferior orbit. The photo image in the right corner illustrates the affected area after undergoing complex reconstructive surgery for a severe noma defect on the left side.



FIGURE 2 Preoperative and postoperative (at different time points) photographs illustrating the extensive reconstructive surgery performed on a 30-year-old woman with a severe NOMA defect. The defect affected all perioral tissues, the nasal region, and the right eye, with surrounding scarring possibly resulting from chemical burns associated with traditional medicine usage. Surgical interventions included perioral/facial reconstruction utilizing a para-scapular flap, ectropion repair, left lower eyelid reconstruction, and nasal reconstruction with a costochondral graft under Facing Africa initiative. Postoperatively, complications emerged, including necrosis of the costochondral grafts used for nasal augmentation, accompanied by a foul smell, and the development of a bulky flap around the cheeks and oral cavity. Additionally, the patient experienced a reduction in mouth aperture size and significant ectropion around the left eye. To address these complications, interventions such as necrotic tissue debridement, flap debulking, ectropion repair, and commissuroplasty were undertaken.

common complications were wound dehiscence, flap necrosis, infection, and hematoma, with an overall success rate of 70%.⁹

The present study identified several surgical complications encountered in noma cases in Ethiopia, including flap necrosis, abscess formation, tenderness, graft site infection, bulking of flaps, disorientation of teeth, dehiscence of the corner of the mouth, infected bone (Figure 1) and plate, mal-positioned flap, decreased mouth opening with ankylosis, sharp neuropathic pain, graft infection and offensive odor (Figure 2). Delayed flap failure was documented in 13 cases (10 women and 3 men). The reasons for flap failure were attributed to delayed infection (Table 1). On the other hand, of the

total 24 cases investigated, 19 were identified as female, while only 5 were identified as male. The disproportionate number of complications observed among females prompts the question of whether this imbalance occurred by chance alone or if there were underlying biological factors contributing to this outcome. To gain a deeper understanding, additional research is necessary to investigate and explore the potential causes behind the higher incidence of complications among females.

Complications arose during the post-operative period, including necrosis of the costochondral grafts used for nasal augmentation, accompanied by a foul smell, as well as the development of a bulky

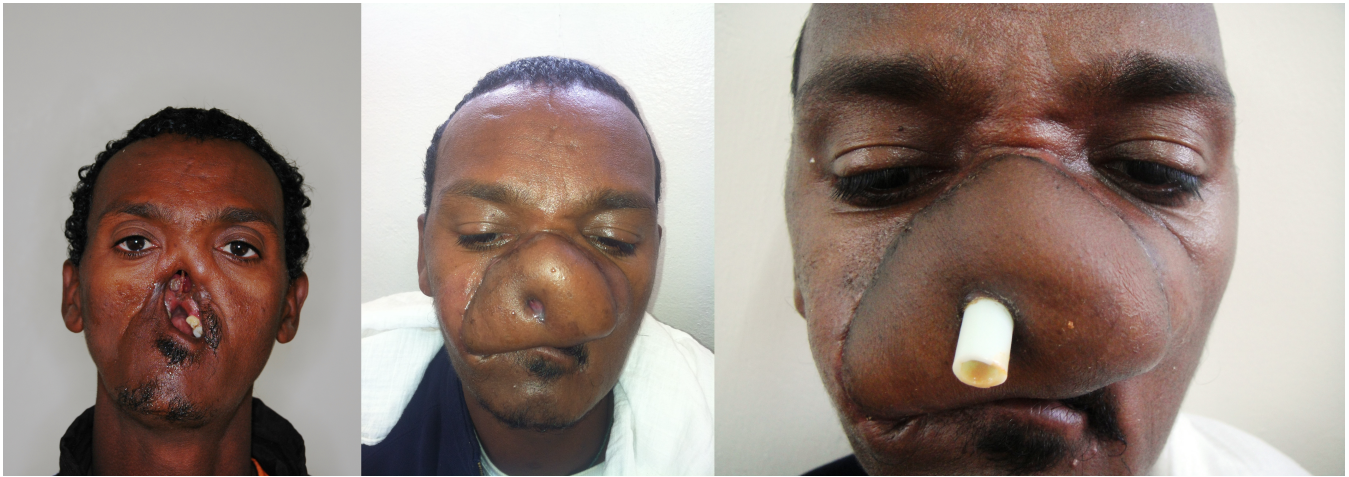


FIGURE 3 Portrays a 33-year-old Ethiopian man who presented with a noma defect affecting his upper lip and nose. The individual underwent two operations, the first in January 2012 to reconstruct his upper lip using a radial forearm flap, and the second in January 2013 to reconstruct his nose with a scapula flap. Unfortunately, the second operation encountered complications, leading to infection. Dissatisfied with the aesthetic outcome and facing difficulty breathing through his nose due to a bulky nasal flap, the patient underwent a third operation in January 2014. This intervention involved debulking and repositioning of the flap to recreate the upper lip and uncover the nasal aperture. The photo in the right corner provides a visual representation of the patient's postoperative condition after the third surgery.

flap around the cheeks and oral cavity. Additionally, the patient experienced a reduction in mouth aperture size and significant ectropion around the left eye. To address these complications, interventions such as necrotic tissue debridement, flap debulking, ectropion repair, and commisuroplasty were performed.

Overall, the findings highlight a range of surgical complications associated with noma surgery in Ethiopia. The specific complications observed and the interventions undertaken (revision surgeries) emphasize the challenges and complexities involved in managing and treating noma cases (Figure 3). These findings underscore the need for further research and strategies to minimize the occurrence of complications, improve surgical techniques, and enhance patient outcomes in noma surgery.

6 | CONCLUSION

The findings of this study assert the significance of multidisciplinary team-oriented preoperative evaluation, meticulous surgical technique, and postoperative care in preventing and managing these complications. Adequate wound management, infection control measures, and patient education on postoperative hygiene practices are also essential to minimize the risk of complications and promote successful surgical outcomes. Furthermore, the outcomes of this study provide valuable insights for healthcare professionals involved in noma management, enabling them to anticipate and proactively address these complications. The revision surgeries identified in this study could also serve as an initial reference to choosing an appropriate treatment approach for clinicians facing similar surgical complications. In general, the knowledge gained from this study can support the development

of protocols and measures to reduce the incidence of complications and to treat complications that do occur.

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CONFLICT OF INTEREST STATEMENT

The authors have declared that no competing interests exist.

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