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Spectrum and the management of glanular-preputial adhesions after ritual male circumcision

Mohamed A. Baky Fahmy[1*], Amr Hussein Elsayed Mohamed[2], Mohamed Fawzy ElSayed Ali AbdAlla[2] and Nour A. Nour[1]

Abstract

Background Complications after male circumcision are numerous and may be presented as an adhesion between the glans penis and the preputial remnants, these adhesions may acquire different forms and troublesome the affected children.

Patients and methods This is a retrospective study of 95 consecutive children of presumed glanular-preputial adhesions referred for correction of circumcision. They were assessed and classified as having either an early preputial adhesion or a well-formed skin bridge into 2 groups; group (A) who have a simple adhesion that was resolved through a conservative preputial adhesiolysis while those in the group (B) had a well-formed skin bridge, which deserves surgical correction. Histopathology done for 30 cases from group B. All cases were followed up till resolution of the adhesion.

Results A wide diversity of the Glanular-Preputial Adhesions (GPA) was recognized with a different form ranged from a simple fibrinous adhesion which was diagnosed in 55 cases (group A), these adhesions were resolved with medical treatment, and a well-formed single or multiple skin bridges formed 3–4 months after circumcision; which were detected in 40 patients (group B) with a smegma pearls in 15, all required a surgical adhesiolysis. Mean age of patients was 3 years (6 months to 12 years). Three cases were diagnosed with penile scleroatrophic lichen balanitis.

Conclusion Glanular-Preputial Adhesions is not a rare complication after MC. It could be a simple fibrinous; which resolves with topical corticosteroid or a well-formed skin bridge which needs surgical adhesiolysis.

Keywords Circumcision, Complications, Prepuce, Glans Penis, Coronal sulcus, Adhesions, Penile adhesion, Synechia and skin bridges

*Correspondence:
Mohamed A. Baky Fahmy
ymabfahmy@yahoo.com; mabfahmy@yahoo.com
[1]Pediatric Surgery Dept, Al-Azhar university, Cairo, Egypt
[2]Urology Dept, National Institute of Urology, Cairo, Egypt

Introduction

Glanular-preputial adhesions (GPA) are often diagnosed in babies and children, whether they have been circumcised or not. In circumcised patients the GPA may be: fibrinous adhesions that form early often in the first post-circumcision weeks, it is made of fibrin and could be managed conservatively with medical treatment (group A), and fibrous, well-formed single or multiple skin bridges GPA that required surgical adhesiolysis (group B). Fibrinous and physiological GPA, better to be labelled as a preputial synechia, and it may be a transient phenomenon. Patients are commonly presented late with a disfigured circumcision scar recognized by the older children or by their parents. Additionally, itching and burning sensations are the common predominant presentations, while painful erection and penile bending are complained by the adolescents. A secondary superimposed bacterial infection, penile chordee and penile scleroatrophic lichen are not a rare sequel. Penile chordee usually develops after a considerable time and it is common with ventral skin bridges. In this retrospective single center study, 95 consecutive children with different forms of glanular-preputial adhesions following non-medical male circumcision (MC), the spectrum and the different available management modalities of this complication well be presented and discussed.

Patients and methods

After obtaining the IRB approval from our ethical committee (219/A/2023), this retrospective cohort study was conducted between January 2019 and March 2023. All enrolled children were referred for evaluation of post-circumcision penile complications following a ritual non-medical MC or other unrelated problems, after which the adhesions were incidentally noted.

Inclusion criteria

Children with any sort of adhesion between the glans penis and the preputial remnants occluding the coronal sulcus after ritual MC. All included children had a normal size of the penis and aged from 6 months to 12 years.

Exclusion criteria

Children who had adhesion after other surgical procedures like hypospadias repair, children with other obvious congenital genitourinary anomalies, patients above 12 years old, and cases of other unrelated penile pathology.

All children were examined and evaluated for the configuration and the degree of GPA or other post MC complications and any associated congenital genitourinary anomalies.

Anthropometrical study for age at MC, penile dimensions, the time elapsed between MC and development of the adhesion, the procedure done for MC, any early encountered complications after the procedure, use of local or general anesthesia if any, and the recovery mode.

The data about the caliber of the surgeon who performed circumcision procedures; wether he was a resident doctor, experienced surgeons or even a paramedical personals were not available.

This study conducted for a consecutive 95 patients; group A 55 infants and children with a fibrinous GPA; which was resolved without surgical intervention, and group B included 40 children with a well-formed skin bridge. Ancillary investigations like urine microscopy and culture were ordered for select cases (40 cases). A histopathology examination of the adhesive specimen was done for 30 cases from group B to confirm the nature of the adhesion and to confirm the diagnosis of any case of scleroatrophic lichen balanitis, bacterial swabs were taken from the area of detected adhesion from all cases and gram staining was done, multiple swabs were taken from cases with multiple adhesions, and cases with any susceptibly to have another inflammatory lesion associating the adhesions. All patients in group A (55) were managed by twice daily application of a topical Diprolene® ointment (Each gram contain contains 0.643 mg betamethasone dipropionate, equivalent to 0.5 mg betamethasone) for 1–2 weeks with a trial of at least once daily preputial retraction after bathing applied by the mothers.

All cases in group B who had a well-formed skin bridge were managed by a surgical adhesiolysis under local anesthesia in 18, and general anesthesia for 22 cases as day cases; fine stitches with an undayed 6/0 vicrly were indicated for 32 cases to cover the raw surfaces. A compression bandage with petroleum gauze was applied and left overnight, and the families were instructed to remove this bandage the next day, and to use Sitz baths for the next 2–3 days. Cases of penile scleroatrophic lichen balanitis were managed initially by local corticosteroid for 3 weeks, followed by surgical excision for any residual skin bridges. Resolution of this specific balanitis was confirmed by dermoscopy done by the dermatologist. Cicatricial phimosis was corrected by a retrograde excision of the constricting distal skin ring under general anesthesia. Children with an evident UTI were managed by the proper antibiotics according to the culture and sensitivity test till the next urine analysis came negative. Cases suspected to have an increased body weight for length percentile were investigated by measuring the body mass index BMI (kg/m^2), however this value is not an objective criterion for diagnosis of obesity, but we implemented this measure as guide for cases with an obvious obesity. The mean follow-up after management of the GPA was 8 months (range 3–10 months). There was no case refused the suggested management, and no patient lost during the follow up.

Table 1A Correlation between circumcision methods and GPA types

Variables		Method of Circumcision (*n* = 95)			*P* value [a]
		Guillotine (*n* = 55)	Surgical dissection (*n* = 15)	Undefined MC (*n* = 25)	
GPA	Group A (*n* = 55)	38 (69.1%)	3 (20%)	14 (56%)	0.003*
	Group B (*n* = 40)	17 (30.9%)	12 (80%)	11 (44%)	

*: Significant *P* value

Table 1B Correlation between the circumcizor level and GPA types

Variables		Circumcision performer and types of GPA (*n* = 95)						
		Non-medical personal (*n* = 28)	GP (*n* = 22)	Obstetricians (*n* = 15)	General surgeon (*n* = 8)	Urologists (*n* = 4)	Pediatric surgeon (*n* = 0)	Undefined (*n* = 18)
GPA	Group A (*n* = 55)	11	10	6	6	4	0	12
	Group B (*n* = 40)	17	12	9	2	0	0	6

GP: General practitioner, GPA: Glanular-Preputial Adhesions

Statistical methods

All data were analyzed by SPSS 9.0.1 statistical package and compared by paired *t* test; the Fisher's two-sided exact test was used to calculate *P* values.

Results

The mean age of all included cases was 3 years (from 6 months to 12 years). The mean age at the time of examination is differed between groups; patients in group A (55 patients) were aged 8 months (6–36), but in group B (40 children) it was 4 years (3–12).

The complaints at presentation were itching and rubbing of the genitalia, which is the main complaint, as it was reported in 35 patients (20 from group A), soreness at the circumcision site in 30 (26 group A), penile bending was the main complaint in 12 (all in group B, and most of them were older than 2 years). Penile disfigurement was reported in 23 (14 group A and 9 group B), dissatisfaction of the post MC scar was reported in 46 children (32 Group B). Detection of all these complaints in group A were statistically significant when it is compared to patients in group B, except the penile dissatisfaction as it is a quiet subjective concept.

Positive bacterial swabs were retrieved from 21 cases (13 group A), a gram-negative, anaerobic Escherichia coli (E coli) is the commonest pathogen (9/21), followed by fecal streptococci (5), enterococci (4), and staphylococcus epidermis (3). Urinary tract infection (UTI) was confirmed in 16 children (10 group A), but only 4 cases were febrile, and other urinary symptoms were reported by another 4 cases. Associating napkin dermatitis was diagnosed in 38/55 children of group A, and it is significantly related to higher incidence of preputial adhesions. There is a correlation between positive bacterial swabs and the UTI.

The guillotine method for circumcision is the most commonly used method (55 cases), Plastibell, Gomco and Mogen clamps methods are not widely practiced in Egypt, but the surgical dissection method was used in the older boys (15). On many occasions the families were not aware, or had not been informed about the method used for circumcision; so, cases with undefined MC method were 25. The relation between the different methods of circumcision and the GPA is presented in Table 1A. There is a statistically significant correlation between the incidence of GPA and the guillotine method of MC than other methods; P is 0.003. In Egypt, there is no regulations for the circumcisor capability and performance; most cases with GPA were circumcised by a non-medical personal (*N*=28) or the GP doctors (*N*=22), the lower incidence of complications was reported with the cases operated by urologists, and there is no cases operated by a no pediatric surgeon. (Table 1B). There are 6 cases from group B diagnosed with a body weight crosses to above the 98th percentile; all from group B and they had an extensive adhesions and multiple skin bridges.

After revision of this considerable number of GPA; those cases could be classified to:

- Partial fibrinous adhesion [28] (Fig. 1A).
- Circumferential fibrinous adhesion [27] (Fig. 1C).
- Well-formed skin bridges; which could be single [25] (Fig. 2A), or multiple [7] (Fig. 2B); affecting the lateral, dorsal or ventral surfaces [19, 8 and 5], with or without a ventral bending [3] (Fig. 2C).

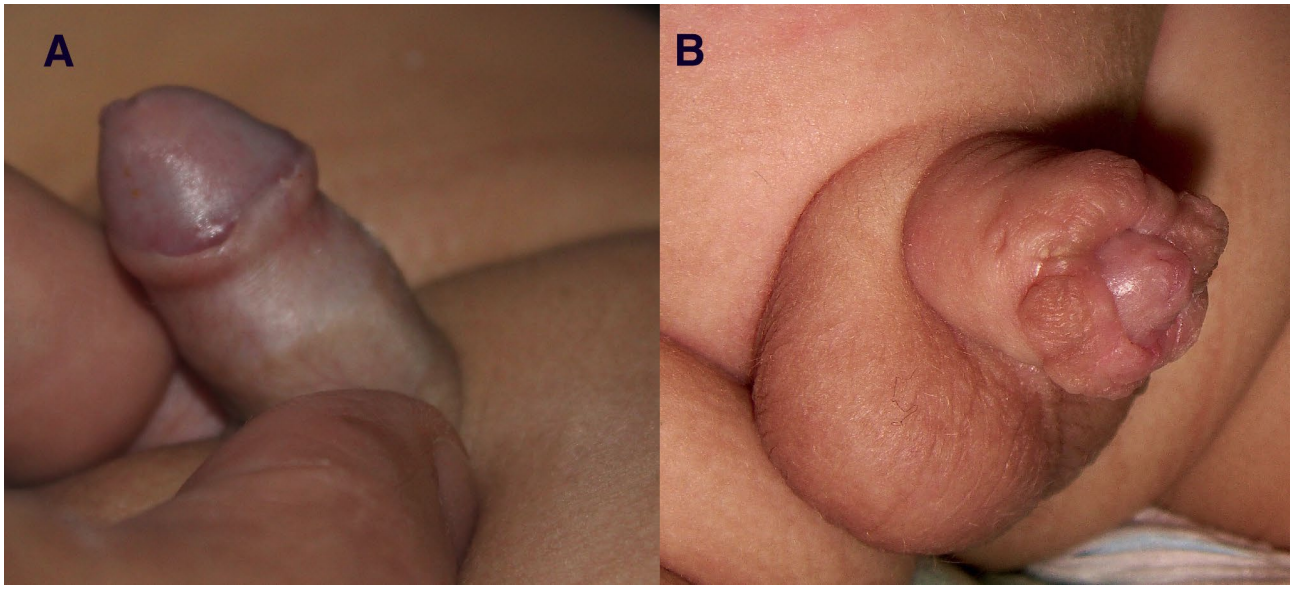

Fig. 1 Partial (**A**) and circumferential (**B**) fibrinous adhesion

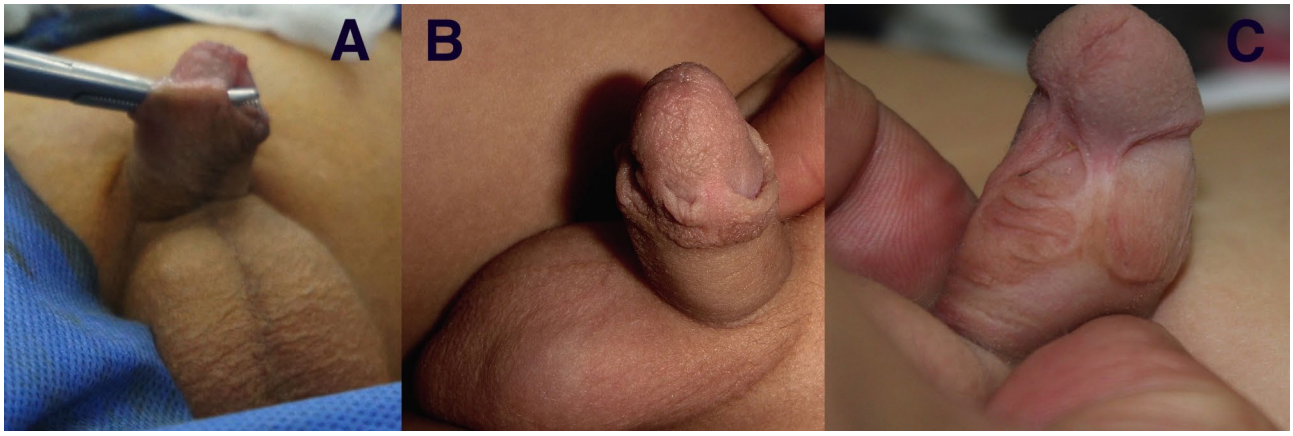

Fig. 2 Well-formed skin bridges; which could be single (**A**), multiple (**B**) and with ventral bending (**C**)

- Adhesions with penile scleroatrophic lichen balanitis [3] (Fig. 3).
- Completely covered glans penis with or without a cicatricial phimosis and concealed penis [8 cases] (Fig. 4A-D). Table 1C.

The scar that covering the glans completely with a stenotic preputial hiatus ending with a cicatricial phimosis were detected in 3 patients (Fig. 4A-B), adhesions that covered 50% of the glans or more were detected in 2 patients (Fig. 4C). Three patients had adhesions that covered less than 50% of the glans penis (Fig. 4D). Adhesions that cover the glans penis and only occluding the coronal sulcus are considered as proximal adhesions, while these adhesions going distally reaching to the urinary meatus are considered distal. Group A patients who were managed by local topical steroid ointment didn't develop any secondary complications or side effects. Children with a cicatricial phimosis showed an acceptable outcome and uneventful postoperative course. Most of the post MC adhesive complications are confined mainly to the distal penile parts; the meatus, coronal sulcus and the distal penile shaft, it is extremely rare to have adhesions affecting the penoscrotal junction except in cases of severe microphallus and concealed penis. The most common definition of obesity in childhood is weight in excess of 20% above ideal weight for age and gender [1]. In group B six children detected to have an apparent overweight; which properly contributes to the development of GPA and skin bridges. Histopathology studies revealed that the nature of the adhesive tissue in group B was a well-formed fibrous tissue; covered with a skin epithelium, but showed no abnormalities and the skin adnexal structures were focally preserved without any evidence of cellular

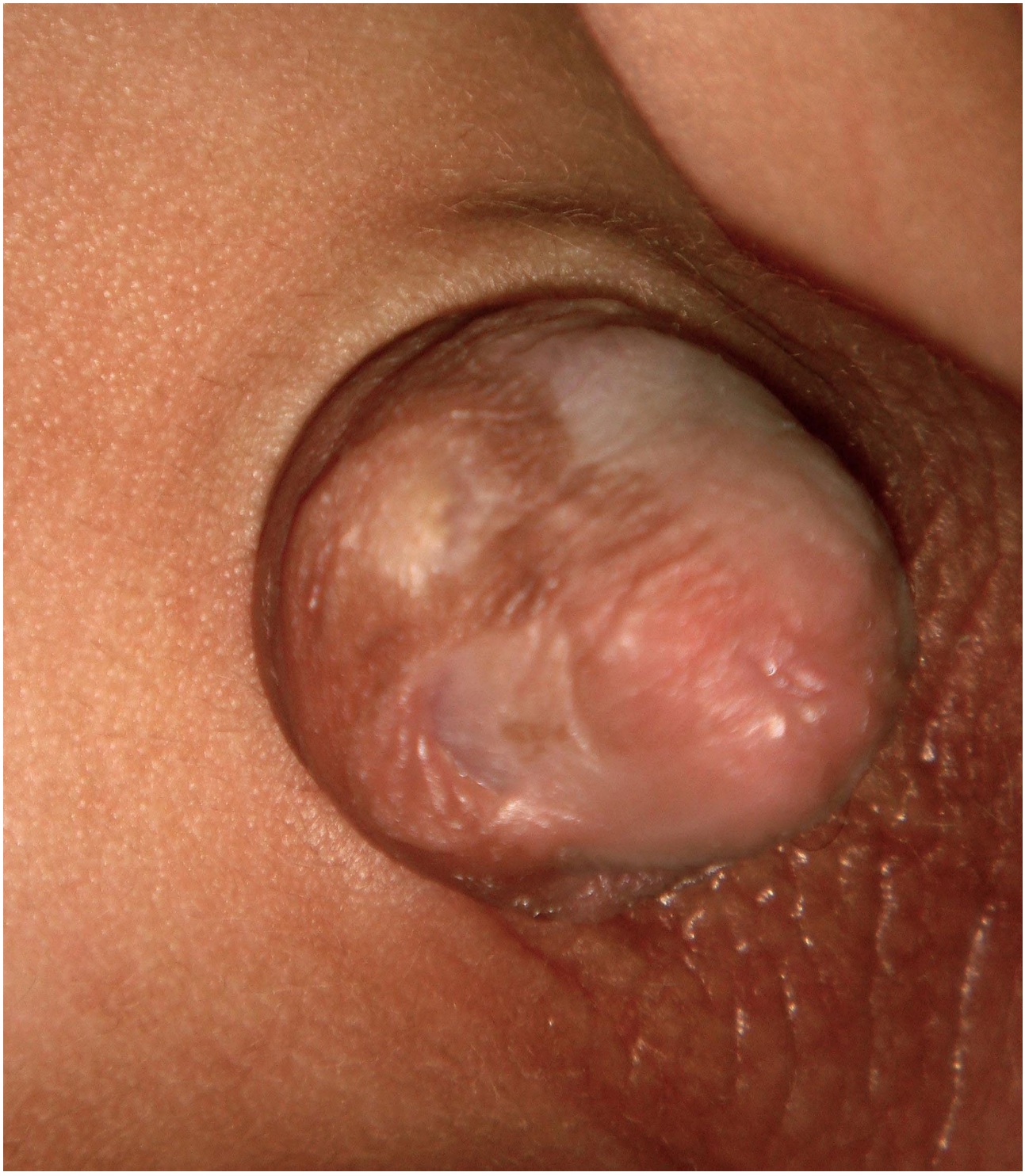

Fig. 3 Multiple adhesions with penile scleroatrophic lichen balanitis

dysplasia. Scleroatrophic lichen balanitis was histopathologicaly proved in the three cases which were clinically suspected; their specimens showed changes in the form of variability in thickness of the excised adhesion tissue, there is area of hyperkeratosis (orthokeratosis) and minimal foci of vacuolated basal cells. The underlying superficial dermal layer showed increased fibrosis and minimal foci of lymphocytic aggregates, the deeper dermis was seen with a focally preserved skin adnexal

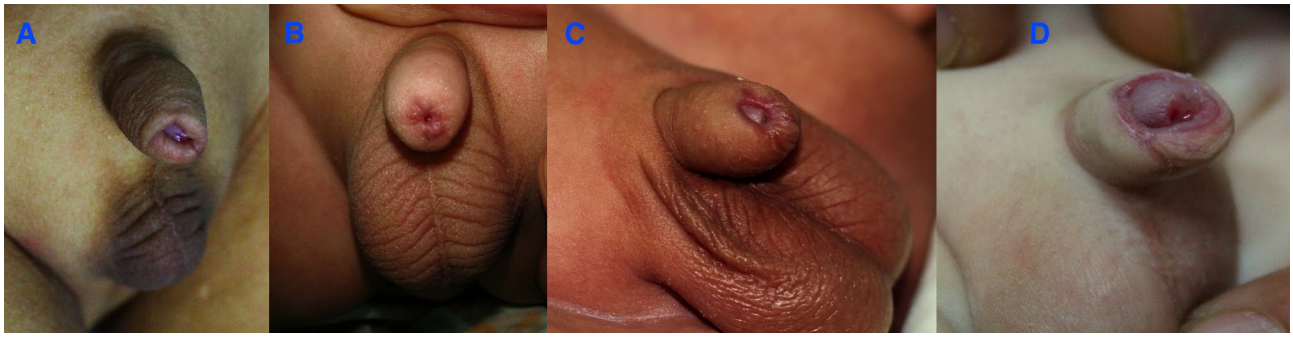

Fig. 4 Different grades of a completely covered glans penis with a cicatricial phimosis (**A**&**B**) and concealed penis

Table 1C Different types of GPA and its percentages

Types	Subtypes	Number	Percentage from total (95)	Figure
Fibrinous adhesion (55)	Partial fibrinous adhesion	28	29.5%	Figure1A
	Circumferential fibrinous adhesion	27	28.5%	Figure1B
Skin bridges (32)	Single well-formed skin bridges	25	26%	Figure2A
	Multiple well-formed skin bridges	7	7%	Figure2B
	Lateral skin bridge	19	20%	Figure2C
	Dorsal skin bridge	8	8.4%	Figure2C
	Ventral skin bridge	5	5.3%	
	Penile bending	3	3%	
	Scleroatrophic lichen balanitis	3	3%	Figure 3
Cicatricial phimosis (8)		8	8.4%	

structures without any cellular dysplasia. All cases of lichen balanitis had a retained smegma particles.

Discussion

In a country like Egypt; about 90% of the male children were circumcised for non-medical reasons despite the higher rate of complications which ranged from 10 to 50%, and a late complication of 7.4% [2]. Regardless of the scientific debate concerning the pros and cons of male circumcision, the emotional, cultural, or religious factors often determine whether or not the procedure to be performed in many countries [3]. But since 1970s, the routine neonatal circumcision has been declining in prevalence in the United States and many European countries [4, 5].

Normally, the prepuce is completely developed by the 16 weeks' gestation. The squamous epithelial lining of the inner prepuce is contiguous with the glans at this stage, so that preputial adhesions are a normal part of development, and it is not a pathologic state. Desquamated skin cells become entrapped on the glans beneath the adhered prepuce, leading to formation of preputial cysts, also known as keratin pearls [6]. The rupture of these cysts allows progressive gradual separation of the inner prepuce from the glans, at the same time the penile growth, with intermittent erection, which aids in the process that eventually completely separates the prepuce from the glans to form the preputial space [7]. Complete retraction of the prepuce beyond the corona is possible in at least 90% of boys by 5 years of age. In contrast, some boys will not have complete separation of the prepuce circumferentially beyond the corona until accelerated penile growth occurs at puberty [8]. As only 4% of the full-term babies had a separable prepuce which could glide easily over the glans; so, most of the neonates who underwent circumcision will subject to a sort of abrasion and denudation of the glandular epithelium at the time of circumcision. The raw surface of the denudate glans will keep it liable to adhere with any other adjacent raw surface resulting in an early fibrinous adhesion; which if not managed it will end with an epithelialized skin bridge.

Adhesions between the glans penis and prepuce in uncircumcised boys or the preputial remnants in circumcised ones are not rare and they may acquire different forms with or without manifestations, Kim et al. reported penile adhesions as being the majority of post MC complications (84.6%), especially in patients weighing > 5.1 kg [9].

Herein, we are concerned only about the preputial adhesion following MC whether it is early or late; generally, these adhesions are fibrous bands that form between different tissues and organs, often as a sequala of injury during surgery, or after a subsequent inflammatory process either physical, chemical or infectious. These adhesions may be thought as an abnormal or pathological scar

tissue that connects two different raw tissues, which are not connected normally.

The term "adhesion" is applied when the scar extends from within one tissue across to another, it is usually across a virtual space [10]. The process of adhesion starts firstly with fibrin deposition which leads to fibrous connections between different tissues or organs. These adhesions can occur in any part of the body, depending on the cause and location, they can be beneficial in tissue healing or could be harmful causing complications [11]. Applying some sort of adhesion barriers during surgery may help to prevent its formation [12]. In penile adhesion the cohesive adhesion ends with skin bridges formation with a variable diversity as described in this study. Some researchers nominate GPA as a post-circumcision corona obliteration [13]. Others terming the dorsal skin bridge wrongly as a dorsal frenulum, but this is an acquired lesion either after or even without circumcision [14]. Ponsky et al. [15] classified the post MC penile adhesion to grades from 0 to 3 (in grade 3 a 50% of the glans was covered). Roughly, the GPA could be proximal; confined to the coronal sulcus or a distal adhesion extended to cover variable extensions of the glans penis. Van Howe [16] found that the circumcised boys under 3 years of age were significantly more likely to have a partially or completely covered glans, and less likely to have a fully exposed glans than those who were circumcised boys of 3 years or older. Among the 238 boys he studied under 3 years, those circumcised were significantly had non-cosmetic problems, including coronal adhesions, he founded that only 35% of the examined children had a fully exposed glans after circumcision, and he reported that coronal adhesions develop in circumcised boys at 2–6 months of age and it usually resolves by 24 months.

After reviewing a diversity of post MC glanular-preputial adhesions we confidently classified these complications into: an early fibrinous adhesion, skin bridges and a cicatricial phimosis. Skin bridges are subsequently classified to single or multiple, and according to their location to a dorsal, lateral or ventral, the least subtype usually associated with a penile bending.

Cicatricial phimosis may be associated with many other sequelae like meatal stenosis and ascending UTI. GPA if not treated early and properly it my results in different forms and degrees of penile bending. Also, these adhesions may harbor a smegma particles, debris and dirt, which subsequently results in different forms of balanitis, or a specific penile scleroatrophic lichen balanitis; which may be developed secondary to chronic exposure to urine which has been proposed to play a role in the etiogenesis. It is postulated that dribbled urine becomes occluded between the inner preputial remnants and the glans, this occlusion and koebnerization precipitate inflammation, which may progress to the characteristic sclerosis of penile lichen balanitis [17]. Other several factors such as genetic susceptibility, autoimmunity, and infections, have been also proposed to play a role in penile scleroatrophic lichen balanitis pathogenesis, which is uncommon in children, and its diagnosis is almost always clinical and supported by histology [18]. So, the detection and confirmation of three cases of penile scleroatrophic lichen balanitis among this group of children with GPA could disclose the substantial hazards of these adhesions. Moreover, a complete circumferential balanopreputial adhesion and a non retractable prepuce could induce sexual dysfunction and urinary dysfunction in the near future of those affected children [19]. Failure to pull back of the penile skin, too much preputial remnants, glanular abrasions and uncapacious penis due to suprapubic excess fat are the most common reported predisposing factors for the formation of the GPA [15]. So, an increased body weight for length percentile in male infants before and after circumcision may be associated with penile adhesions with a hidden penis which facilitates contact between the raw surfaces of the abrasive glans and circumcision scar resulting in a different forms of penile skin bridges, the same finding is also detectable in cases of an isolated suprapubic obesity [20]. In this study six cases from group B were diagnosed to have an overweight which predisposes to GPA formation.

Sometimes, the GPA pass asymptomatic, but itching, burning sensation, white smegma collection, concealed penis in the pubic fat pad; giving a false impression of buried penis and tugging feeling during erections in older children are a common presentations. As Urinary tract infection (UTI) is one of the most common bacterial infections of childhood; affecting about 6–8% of infants and children, and its diagnosis was suggested when ≥10 WBCs/μL detected on urinalysis of a properly collected urine specimen [21]. In this study UTI is confirmed in 16 children, but only 4 were febrile infants, and other urinary symptoms reported by another 4 cases. *Escherichia coli* is the common organism detected in children from this study with a positive bacterial swabs; as (*E.coli*) is the most common uropathogen, responsible for approximately 80% of pediatric UTIs in many studies [22].

The incidence of napkin dermatitis is high in developing countries; reaching 15.2% in Egypt [23], and it is significantly related to the higher incidence of preputial adhesions in group A patients.

In order to prevent or to minimize the incidence of GPA in communities that insisted to practice MC, parents should be instructed to retract and clean any skin covering the glans in circumcised boys, to prevent adhesions formation and debris accumulation. Circumcision is a surgical technique demanding a skillful surgeon to do it with a meticulous handling, with avoiding the ligation of the frenular artery. Post circumcision regular

compression of the suprapubic area to make the penis protrude and placement of petroleum jelly or any other such ointment will be helpful to minimize post MC complications. The varying degrees of techniques and skills used for circumcision are definitely affect the incidence and the degree of post MC glanular preputial adhesions, the circumcised penis requires more care than the intact penis during the first 3 years of life [15].

Part of the obstacles with adhesion management is the lack of an objective clinically relevant classification to allow their study. Petroleum jelly is used on the penis after MC to keep the skin soft and movable. Also, Seprafilm (made by Genzyme) is a clear, sticky film composed of chemically modified sugars, some of which occur naturally in the human body [24], it sticks to the tissues to which it is applied and is slowly absorbed into the body over a period of seven days, it is approved for use in certain types of pelvic or abdominal surgery. Several other products are available for adhesion prevention outside the abdominal and pelvic cavities [25].

Snodgrass [26] used a coating of fibrin glue over the raw surface to avoid GPA. Van Howe [16] reported that coronal adhesions develop in circumcised boys at 2–6 months of age and it usually resolves by 24 months. Topical steroid cream that can be used at home; as the steroid cream will thin the skin around the adhesions, allowing them to be slowly resolved over time as the penile skin is pulled back with each diaper change. Steroid cream can, however, cause skin discoloration; either getting lighter or darker in the surrounding penile skin. Penile adhesions can be repaired in a urologist's office, and it well tolerated with excellent safety and efficacy for children [27]. With only 36% of patients treated with the home-care regimen completely or substantially resolved adhesions after a median of 6 months as reported by Pitts et al. [28] who stated that parents of their studied group of patients with GPA patients (429) were offered two treatment modalities; either a home-care with daily retraction of the foreskin or adhesiolysis. So, their management options were distributed according only to the families' wishes, and they didn't consider the severity or the type of GPA. The higher rate of recurrence after lysis of penile adhesions has led to a reevaluation of the management algorithm for this diagnosis [29].

In this study the decision about either conservative or surgical management was taken according to clinical evaluation of the type of GPA, and the management strategy was discussed with the families, also, the older children (aged from 10 to 12 years) were incorporated in the discussion and the decision about the available two options of management. Conservative management of fibrinous adhesion with local corticosteroid (triamcinolone) was effective and no patients with fibrinous adhesion were switched from conservative to surgical options [30]. Recurrence was encountered only in two patients of group B. It is clear that some of the group B patients may represents the later evolution from group A, as the penile adhesions in young children is directly related to maturation, but this is difficult to prove objectively. Usually, the incomplete adhesiolysis is more commonly seen with neonatal circumcision. A stricter follow-up in the early postoperative period after MC may be helpful to reduce the incidence of GPA.

Conclusions

Post circumcision penile adhesion is an albeit significant complication following circumcision; it could be dorsal, lateral, ventral, single, multiple and a cicatricial phimosis. These adhesions could be presented as fibrinous type which could be managed with local corticosteroid, but the different forms of skin bridges and cicatricial phimosis deserve surgical adhesiolysis.

Abbreviations

MC	Male Circumcision
GPA	Glanular-Preputial Adhesions
SB	Skin Bridge
UTI	Urinary Tract Infection
BP	Body Mass Index BMI and Buried Penis
IRB	Institutional Review Board

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12894-024-01672-9.

Supplementary Material 1
Supplementary Material 2
Supplementary Material 3
Supplementary Material 4
Supplementary Material 5
Supplementary Material 6
Supplementary Material 7
Supplementary Material 8
Supplementary Material 9
Supplementary Material 10
Supplementary Material 11
Supplementary Material 12
Supplementary Material 13
Supplementary Material 14
Supplementary Material 15
Supplementary Material 16
Supplementary Material 17

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Author contributions
Dr. Mohamed and Dr. AbdAlla examined all cases primarly, collected data and they wrote the draft of this manuscript. Dr. Nour and Dr. fahmy suppervised all the process of collecting data and managed all cases who needed intervention.Dr. Nour did all the statistical studies and revised the manuscript. Dr. Fahmy revised all data and the final manuscript.

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Data availability
Data is available with the corresponding author upon request.

Declarations

Ethics approval and consent to participate
After obtaining IRB approval of Al-Azher university, Cairo, Egypt (219/A/2023), this cohort study was conducted between January 2019 and March 2023. The parents of all children enrolled in the study signed written informed consent to include their children in the current study. We obtained written informed consent to the use of unidentifiable images of children photos for publication. All images included in this study were consented to publication by the parents. Consent forms were provided to the journal for evaluation.

Consent for publication
available in the supplementary materials.

Competing interests
The authors declare no competing interests.

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