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Aesthetic Scrotoplasty: Systematic Review and a Proposed Treatment Algorithm for the Management of Bothersome Scrotum in Adults

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Abstract

Background Increased scrotal laxity is a poorly defined entity often associated with discomfort while wearing loose clothes, walking, doing sports and during intercourse. In our experience, this condition is produced by an enlarged scrotal bag hanging more than 1–2 cm below the tip of the penis and can be associated with persistent penoscrotal webbing. Our objective was to perform a systematic literature review addressing the diversity of this entity and its surgical treatment, as well as propose a diagnostic and therapeutic approach.

Methods A systematic search strategy was performed following PRISMA guidelines under the terms: Scrotum(Mesh), Plastic Surgery(Mesh), Reduction Surgery, Scrotoplasty, Ventral Phalloplasty, Scrotomegaly, Penoscrotal Web, Webbed Penis(Mesh), Scrotal Lifting, Scrotopexy and Scrotal Tuck. Articles referring to scrotum reduction or plasty in male genital rejuvenation context and ventral phalloplasty related to adult penoscrotal webbing correction were considered eligible for analysis. A management algorithm and surgical technique is proposed along with the results.

Results A total of 1430 articles were found. After removing duplicates and applying inclusion and exclusion criteria, 11 articles were eligible for analysis. Most articles corresponded to case reports or surgical technique descriptions. Based on correcting excessive scrotal skin and/or penoscrotal webbing, we propose a vertical midline scrotal skin resection and a penoscrotal junction Z plasty, respectively.

Conclusions Aesthetic scrotoplasty and scrotal rejuvenation surgical techniques still remain as entities poorly addressed in the international literature. More reported experiences are needed in order to complement our proposed management algorithm and develop a nomenclature, diagnostic and treatment consensus.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to Table of Contents or the online Instructions to Authors www.springer.com/00266. Genital Surgery

Keywords Aesthetic scrotoplasty · Scrotum reduction surgery · Scrotal lifting · Scrotomegaly · Scrotopexy

Introduction

Interest in aesthetic surgery among men has been increasing over the last decade. According to ISAPS 2018 statistics, the main surgical procedures in males were gynecomastia reduction, liposuction and facial aesthetic surgeries [1]. Even though genital cosmetic procedures are not among the most frequent, masculine perception of genitalia can have a significant effect on self-esteem. Therefore we believe it is relevant for plastic surgeons to be familiar with male genital rejuvenation techniques [2].

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The scrotum is a cutaneous pouch divided in its surface into two portions by the median raphe, extending from the anus along the perineum to the ventral surface of the penis. These are not fully symmetrical, with the left side usually hanging lower than the right, due to a greater length of the spermatic cord. The scrotal wall is very elastic and is composed from superficial to deep by rugated skin, superficial fascia (Dartos), external spermatic fascia, cremasteric muscle and the internal spermatic fascia. Testicles lie suspended inside the scrotum and are surrounded, from superficial to deep, by the parietal and visceral layers of the tunica vaginalis and the tunica albuginea [3].

Scrotal rejuvenation has been classified by Cohen in hair associated scrotal changes (alopecia and hypertrichosis), vascular associated changes (angiokeratomas) and morphology associated changes (wrinkling and laxity). Most of these scrotal changes can be treated medically or with minimally invasive procedures, with the exception of scrotal laxity [4]. Increased scrotal laxity is a poorly defined entity, which can also be found in the literature as a low hanging scrotum, testicular ptosis, sagging scrotum or scrotomegaly, with most of these changes related to aging (due to decreased Dartos tone) and gravity dependent stretching. Even though there is no consensus in literature about what is considered a "normal hanging" scrotum, patients with abnormally lax scrotums can complain of discomfort while wearing loose and short clothes, walking, doing sports and during intercourse. Based on our clinical experience in genital surgery and traditional anatomical, cultural and artistic characterizations of male genitalia, we have noticed that the representation of a "young hanging" and aesthetically pleasing scrotum coincides approximately with the distal penis in a standing position. Therefore, we suggest defining a "low hanging scrotum" as an enlarged and redundant scrotal bag hanging more than 1 or 2 cm below the tip of the flaccid penis. Treatment of this condition is mainly surgical, with some authors reporting the use of absorbable suspension sutures [5, 6].

A bothersome or symptomatic scrotum in adults can also be caused by another separate entity such as persistent penoscrotal webbing (or in combination with increased scrotal laxity). Penoscrotal webbing or "webbed penis" is a pathological condition more commonly affecting children where the scrotal skin extends onto the ventral penile skin and can be either congenital or acquired.

Scrotal reduction surgery techniques reported in the literature have been mainly focused on transgender surgery, correction of scrotal lymphedema, scrotal calcinosis and adult penoscrotal webbing. However, when expanding this search to Google, multiple commercial sites offer aesthetic scrotal surgeries using a variety of terms such as scrotoplasty, scrotopexy, scrotal lift, scrotal tuck, scrotum reduction and ventral phalloplasty.

The objective of our study was to perform a systematic literature review addressing the diversity of this entity and its surgical treatment, as well as propose diagnostic criteria and a therapeutic approach together with the authors' preferred surgical technique.

Methods

A PRISMA compliant literature review was conducted by the authors. On June 20, 2020, a systematic Pubmed search was performed including the terms: Scrotum (Mesh), Plastic Surgery (Mesh), Reduction Surgery, Scrotoplasty, Ventral Phalloplasty, Scrotomegaly, Penoscrotal Web, Webbed Penis (Mesh), Scrotal Lifting, Scrotopexy and Scrotal Tuck. On August 31, 2020, the search was expanded using Web of Science and Google Scholar engines under the same terms, reviewing the first 100 results (when available) for each entry. Articles referring to scrotum reduction or plasty in male genital rejuvenation context and ventral phalloplasty related to adult penoscrotal webbing correction techniques were considered eligible for analysis. Only English or Spanish articles were considered. Those referring to scrotal surgical techniques in context of pediatric (pre puberal) webbed penis, penile prosthesis adjuvant surgeries, transgender surgery, infectious diseases (i.e., Fournier's gangrene), oncologic reductions (i.e., Paget's disease), ectopic testicles, cryptorchidism, scrotal transposition, lymphedema, scrotal calcinosis, inguinoscrotal hernias, Peyronie's disease, varicocele, hydrocele and post-trauma reconstruction were excluded. Incomplete (abstracts), duplicated or unavailable full text articles were excluded. A descriptive analysis was made with the articles included in our review emphasizing on the diversity of definitions and surgical techniques proposed for the treatment of penoscrotal web in adults and/or increased scrotal laxity. In this context, we present our management algorithm and preferred surgical technique.

Results

A total of 348 articles were found in PubMed. After inclusion and exclusion criteria were applied, a total of 7 articles were identified as eligible. When expanding the search to Web of Science and Google Scholar, 269 articles and 813 entries were found, respectively. After removing duplicates and applying inclusion and exclusion criteria, only 1 additional article was considered eligible. Additionally, we made a direct analysis of each selected article's references with the same criteria, further adding three references, summing a total of 11 articles finally reviewed by the authors (Fig. 1).

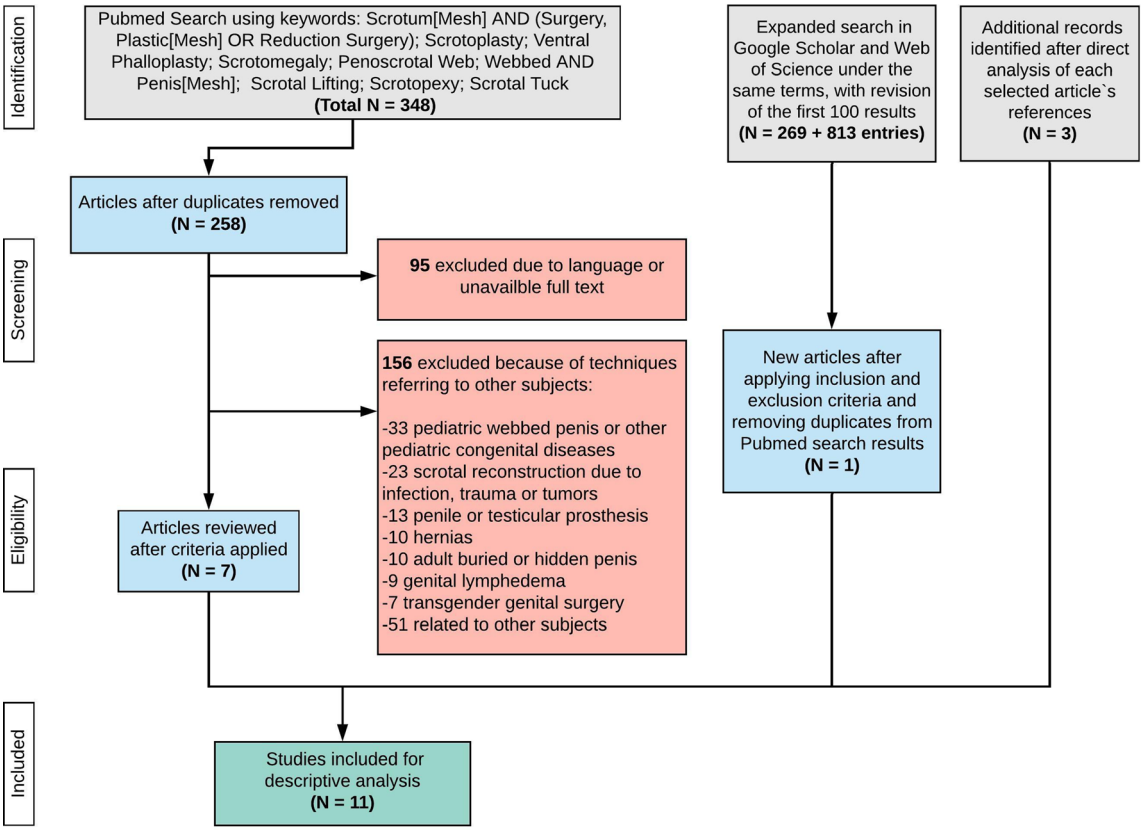

Fig. 1 PRISMA systematic search strategy

A comparative table was made regarding the results based on nomenclature used, entity (context) and described surgical technique (Table 1).

Based on the information gathered and our clinical experience, our proposed management algorithm is shown in Fig. 2. Adult patients consulting for bothersome scrotomegaly usually refer discomfort while walking, using loose clothes, doing sports and during intercourse, as well as an aesthetic concern for the appearance of their genitalia. As previously stated, we have seen that this novel condition relates to either objectively increased scrotal laxity, the presence of penoscrotal webbing or a combination of both. An illustration of these anatomical alterations can be seen in Fig. 3a, b, respectively, together to our preferred aesthetic scrotoplasty technique (3C) which addresses both elements (when present), based in a vertical resection of the excess scrotal skin along the ventral median raphe and a penoscrotal junction Z plasty.

The case of one of the patients treated at our institution is detailed. A 65-year-old healthy male consulting for an aesthetic concern regarding its genitalia with discomfort during sexual activity presented to our office. Upon scrotal examination, both an objectively increased laxity and penoscrotal webbing were found. Our proposed aesthetic scrotoplasty technique was indicated and can be seen in Supplementary Video 1. The amount of scrotal skin and Dartos fascia to be excised is determined by a preoperative pinch test with the patient standing and with a flaccid penis. A Z plasty is designed at the penoscrotal junction with 2 cm arms in a 60 ° angle, but their length can be adjusted to the extension of the penoscrotal web along the ventral penile skin. Surgery is performed under general or spinal anesthesia. Skin and Dartos fascia are resected according to markings and ensuring optimal hemostasia. Z plasty flaps are transposed and closure is performed with 4–0 poliglecaprone resorbable sutures in two separate planes, Dartos fascia and skin. The Dartos fascia is sutured at the level of the scrotal septum and the skin is sutured over this junction, achieving an anatomical restoration of the middle scrotal raphe. Figure 4 shows pre (4a) and postoperative (4b) photographs of the case presented. The patient was discharged the same day and evolved uneventfully. Four to six weeks after the surgery, the patient resumed sexual activity with resolution of previous scrotal symptoms. The patient also reported great satisfaction with the aesthetic result of his genitalia as well as normal scrotal skin sensitivity.

Table 1 Systematic literature review findings of surgical techniques for the treatment of penoscrotal web in adults and/or increased scrotal laxity

Author (Year)	Term used	Context	Surgical Technique	Observations
Glanz S. (1968) [9]	Unusual penile deformity	1st article describing a case of penoscrotal webbing in adults	Multiple ventral Z plasties along the penoscrotal junction together with a circumcision and dorsal z plasty	Case report, 57-year-old male consulting for "a small penis" associated with inadequate sex life. Surgery achieved a 5 cm penile increase, according to the author
Alter GJ. (2007) [10]	Penoscrotal web	Adult penoscrotal web, congenital or acquired, most frequently after inadvertent over-resection of ventral penile shaft during circumcision	Ventral single or double 60° Z plasties (central limb placed along median raphe centered at the web in the penoscrotal junction), with or without skin excess resection. Incisions are made through skin and superficial dartos fascia	Skin excision amount is determined with the penis erect by injecting prostaglandin E1 in order to ensure that an over-resection of skin is not done
Chang et al. (2008) [11]	Penoscrotal web	Adult penoscrotal web, proposal of a new technique	V-Y advancement flaps from ventral skin at penoscrotal junction. The "V" is configured with a 60° opening and 1 cm arms. The technique can be repeated 1.5 cm below the previous V-Y for further tissue gain	Authors describe 0.6 cm skin length gain with each V-Y
Gil T et al. (2010) [12]	Penoscrotal Web	Recurrent symptomatic post-circumcision penoscrotal webbing	Five flap (or Jumping Man) technique at the ventral penoscrotal junction The theoretical lengthening of the five-flap procedure is 75% for the double-opposing Z plasty, and 50% for the V-Y plasty (125% in total)	Case report, 20-year-old male suffering from post-circumcision penoscrotal with restriction in penile erection and inability to penetrate during intercourse due to the web-tethering effect. A Z plasty had been previously performed, with sub-optimal results
Agrawal R et al. (2010) [13]	Webbed Penis	Described as a rare congenital anomaly where a normal sized penis is hidden in the adjacent scrotal and pubic tissues	Ventral double Z plasties on penoscrotal junction	Case report, 17-year-old male
Alter GJ et al. (2011) [2]	Scrotal Reduction, Penoscrotal Web	Low hanging scrotum due to aging, hydrocele, varicocele or increased congenital laxity	A horizontal excision of the mid to upper scrotum is performed, allowing removal of excess scrotal skin along with the underlying Dartos fascia	Care should be taken to preserve the posterior scrotum due to its superior lymphatic drainage, as well as good hemostasis to prevent hematoma
		Penoscrotal web either congenital or after ventral penile skin over resection from circumcision	For penoscrotal web correction describes three techniques at the penoscrotal junction: transverse incision with vertical closure; single or double Z plasties along the raphe (with or without excess skin resection) and V-Y closure	
Chen YB et al. (2012) [14]	Webbed Penis	Deformity in which the scrotal skin extends onto the ventral penile skin, either congenital or acquired (mainly by an overly aggressive removal of skin during circumcision)	With the penis held gently at a right angle to the abdominal wall, a longitudinal incision is made along the ventral median raphe from the bump on the penis to the scrotal skin at the level of the upper edge of the pubic symphysis. The skin and Dartos fascia of the penis are cut and the scrotum's deep fascia is dissected from the urethral corpus spongiosum so they become dissociated down to the root of the penis	They suggest that the pathological anatomy of webbed penis is the adhesion of full-thickness scrotal skin to ventral penile skin

Table 1 continued

Author (Year)	Term used	Context	Surgical Technique	Observations
Lorenzo et al. (2015) [7]	Bothersome Scrotomegaly Excess Scrotal Skin, Megascrotum,	Two case reports, 15- and 17-year-old males complaining of redundant scrotal tissue with marked laxity that produced discomfort during physical activity and concerns regarding cosmetic appearance	Traction stitches are placed laterally at the scrotum and two parallel horizontal lines are marked: posteriorly along the perineum border of the scrotum and at the most dependent point of the scrotum based on an estimate determined preoperatively with the patient standing up. The median raphe is incised, connecting the two lines in the midline down to the Dartos fascia plane, which is followed laterally, raising two rectangular skin flaps up to the lateral scrotal margin which then are excised, removing the redundant scrotal skin. The Dartos fascia is then plicated and the skin is sutured posteriorly at the base of the scrotum	Authors propose several benefits to their technique such as a posteriorly located incision that conceals the surgical scar and prevents iatrogenic penile webbing. Also, as dissection remains superficial to the Dartos fascia, there is no risk to injure the testicles or cord structures
Cohen. (2018, 2019) [4–6]	Scrotal Laxity, Low Hanging Scrotum, Sagging Scrotum, Scrotomegaly	Analyzes several scrotal changes and their rejuvenation techniques Refers to nomenclature diversity such as Scrotal Lift, Scrotal Tuck, Scrotoplasty, Scrotum Reduction and Scrotopexy	Proposes a nonsurgical treatment to scrotal laxity using absorbable suspension sutures (*SCROTUM* procedure)	Mentions Alter's and Lorenzo's surgical techniques as invasive options

Discussion

When searching "Scrotal Reduction'' at the Google web search engine, more than 900,000 results are retrieved, many of them from physicians discussing and offering this procedure, along with magazine reports and patient-oriented blogs discussing its benefits based on personal experiences. However, our comprehensive literature search yielded few articles directly related to aesthetic surgical correction techniques addressing symptomatic adult scrotomegaly. Furthermore, the quality of the evidence found was low, mainly including case reports and technical descriptions. Unfortunately, no clear definition or diagnostic criteria exist for this condition. Unsurprisingly this is associated with a lack of management consensus. With the exception of Cohen's [4–6], Alter's [2] and Lorenzo's [7] reports, we found no more articles specifically referring to treatment modalities for bothersome scrotomegaly in the context of increased scrotal laxity. The first proposes a nonsurgical lift of the scrotum using absorbable sutures and the two latter describe horizontal resection patterns, either of the mid to upper scrotum or of the lower scrotum with a posteriorly oriented closure into the perineum. Similarly, Ehle et al. [8] described the resection of excessive scrotal tissue using a posterior W-shaped incision but in a pediatric 2.5-year-old patient with idiopathic congenital dysmorphic megascrotum. We believe that a vertical skin resection pattern is better than a horizontal one because it restores the scrotum in a more anatomical and aesthetically pleasant way, by placing the resultant scar in the median raphe. This would also theoretically allow better preservation of scrotal sensitivity, as the genital branch of the genitofemoral nerve and the ilioinguinal nerves run from lateral to medial.

On the other hand, when analyzing adult penoscrotal webbing correction techniques [9–14], our search results indeed expand, but are still a minority compared to pediatric related articles. Congenital webbed penis is a form of male genital hypoplasia, which manifests with a pseudo-small, curved penis often associated with psychological and functional problems. Acquired webbed penis is more common and is usually caused by an overly aggressive removal of skin from the underside of the penis during circumcision. Incidence is not well known, but it has been reported by El-Koutby and El Gohary to affect up to 4% of male children. These authors also proposed a new classification system, dividing it in primary (either simple, based on the compromise of the web to the proximal, middle or distal third of the ventral penis, or compound, related to the morphology of the penoscrotal web) and secondary webbed penis [15].

As most cases are mild and asymptomatic, surgical treatment for pediatric patients could be controversial [14]. However, in adults it can cause greater impact, especially

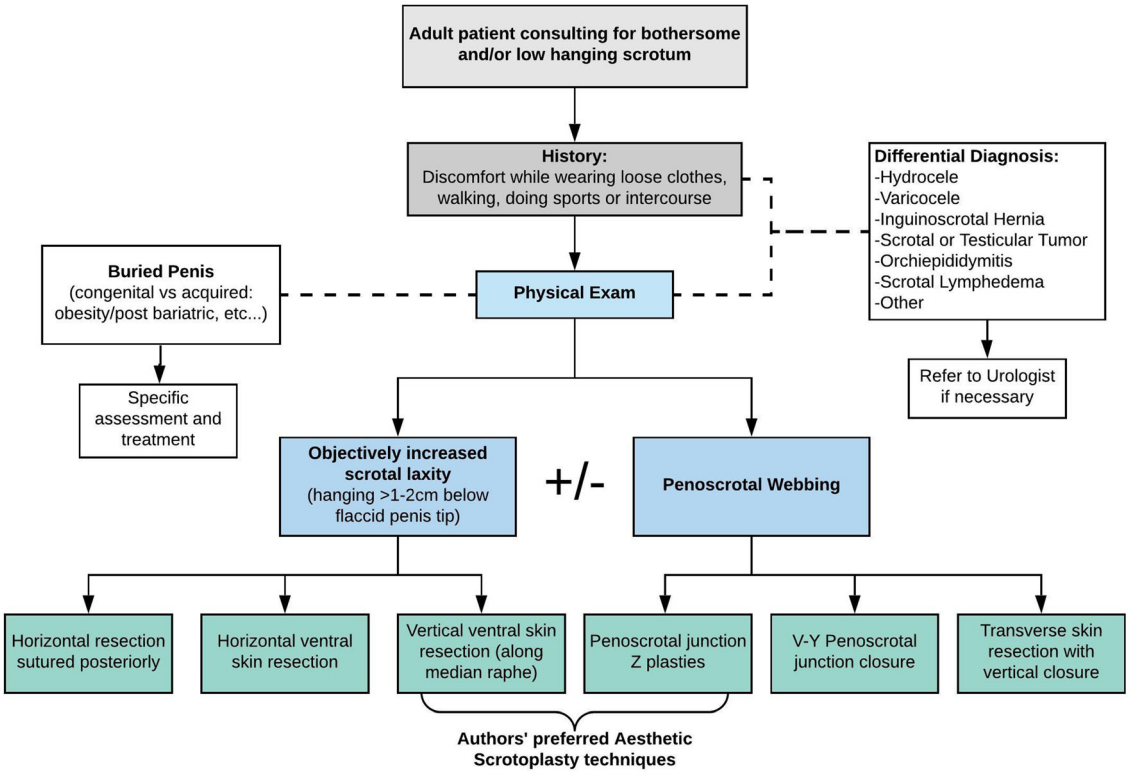

Fig. 2 Author's proposed management algorithm

related to sexual discomfort. Multiple scrotoplasty techniques have been described in the pediatric webbed penis context (not associated with hypospadia), such as: a complete exteriorization of the penis shaft and reconstruction of the penopubic and penoscrotal angles [16], incisions parallel to the penile shaft releasing the penis from the scrotal bed with subsequent flap closure ventrally [17], a circumcision incision extended vertically to ventral penile skin in order to take advantage of the foreskin to reflect the rest to the base of the penis [18] and Heineke-Mikulicz (transverse incision with vertical closure at the penoscrotal junction), Z plasty or V-Y scrotoplasties [19]. On the other side, techniques described in adults are: ventral resections limited to the penoscrotal web [2], ventral incision with dissection of scrotal adhesions to the deep fascia [14], multiple penoscrotal junction Z plasties [9, 10], V-Y closure of the ventral skin [11] and the five flap technique [12]. In our opinion, a Z plasty at the penoscrotal junction not only helps to restore this anatomical landmark, but also allows to compensate eventual vertical skin resection (which is limited to de perineoscrotal junction posteriorly), avoiding a dog-ear deformity.

Other articles referring to scrotal reduction techniques are related to scrotal lymphedema resections which generally consist in massive tissue debulking (Charles procedure) with scrotal reconstruction using adjacent healthy skin associated with skin grafts when necessary [20]. Scrotal resection patterns have also been proposed in the context of scrotal calcinosis, oncological and infectious diseases, however these are determined by the area of scrotal skin affected [21–23]. Regarding ventral phalloplasty techniques, Z scrotoplasty has been also widely used in the context of penile prosthesis implantation with the goal of improving patients' satisfaction as well as a perception of increased penile length after surgery [24, 25].

Finally, when evaluating an adult patient with a bothersome or symptomatic scrotum, it is crucial to make a complete medical history as well as scrotal and testicular physical examination in order to detect and refer to the urologist any other condition associated for adequate study and treatment. Similarly, caution must be taken when suspecting a buried or hidden penis which is a well-described pathological condition. Maizels et al. distinguished different conditions regarding hidden or concealed penis, describing as a buried penis one in which the penile shaft is buried below prepubic skin; a webbed penis in which the penoscrotal skin webs the penoscrotal angle (previously discussed); a trapped penis when the shaft of the penis is entrapped in scarred skin following trauma or iatrogenic circumcision and a micropenis as a normally formed penis that is less than 2 standard deviations below the mean in stretched length and usually is a consequence of an

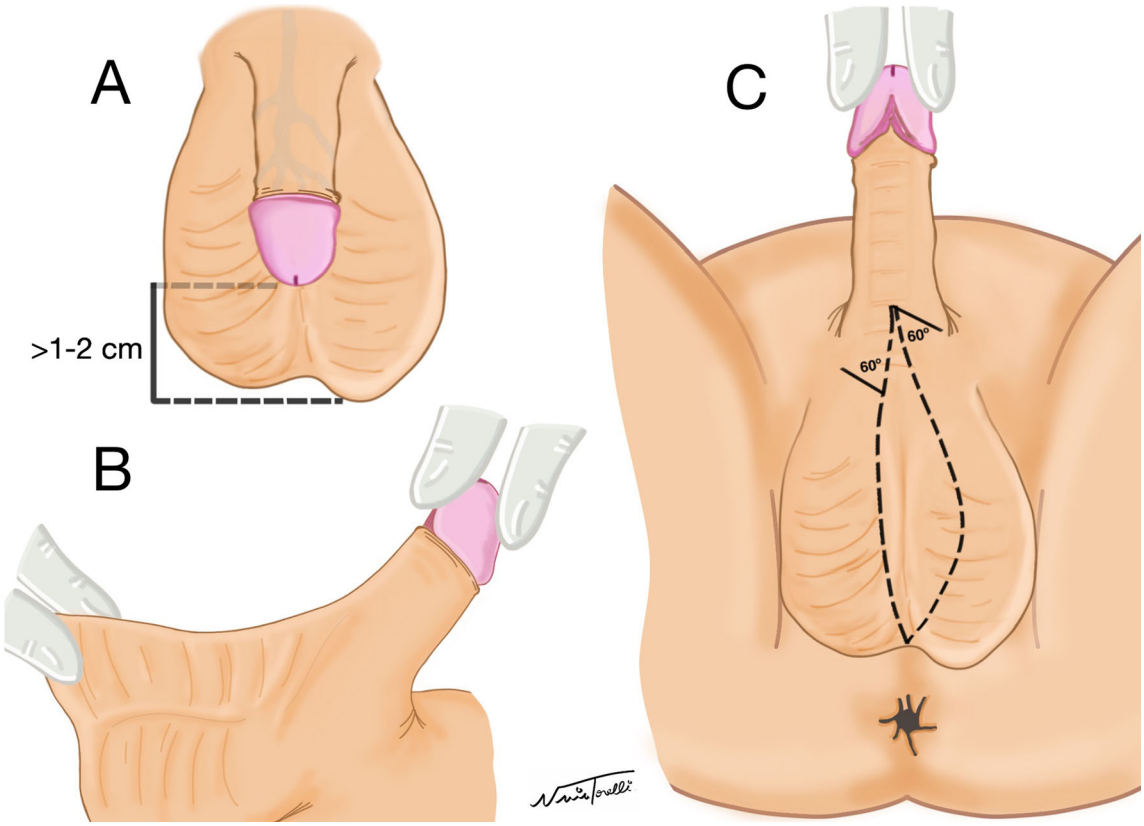

Fig. 3 (**a**) Increased scrotal laxity, (**b**) presence of penoscrotal web and (**c**) our preferred aesthetic scrotoplasty technique design including a vertical skin resection together with a Z plasty in the penoscrotal junction, when both elements are present

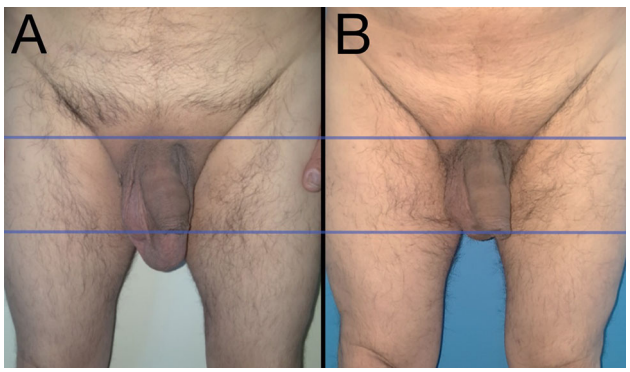

Fig. 4 (**a**) Preoperative and (**b**) postoperative appearance of a 65-year-old male with increased scrotal laxity and penoscrotal web treated with vertical resection and Z plasty

underlying endocrinopathic condition [26]. When presented in adults, buried penis is usually determined by two predominant etiologic components: excessive adiposity and abnormal penile scar tissue formation, requiring different specific therapeutic approaches [27, 28].

Limitations to our study include the development of a treatment algorithm based on the scarce evidence found in our systematic review as well as our limited clinical experience treating patients with this uncommon condition. Also, we lacked the use of other search engines such as Embase to complement our systematic review. However, being such a poorly defined subject, we believe that our study has the value of being the first integrated approach to this novel condition. Further research is needed along with greater clinical experience in the treatment of these patients to better define their management options and refine the aesthetic scrotoplasty technique hereby proposed.

Conclusion

Bothersome scrotomegaly and aesthetic scrotoplasty techniques still remain as entities poorly addressed in international literature. Here we present a systematic literature review mainly addressing the few evidence available and the great diversity of descriptions related to this condition, along with a proposed diagnostic approach and management algorithm. More reported experiences are needed to complement our work and develop a nomenclature, diagnostic and treatment consensus.

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Compliance with Ethical Standards

Conflict of Interest The authors declared that they have no conflict of interest.

Ethical Approval All procedures performed involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Patient pictures have been anonymized and authorized for publication after filling the institutional consent form.

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