INTRODUCTION

The updated classification of the International Society for the Study of Vascular Anomalies has divided vascular anomalies in 2 major groups: tumors and malformations. The last group is subdivided according to the involved vessels, flow speed, and associated anomalies. Venous malformations (VMs) are characterized by abnormal enlarged, and dysplastic veins, with slow-flow speed. They may be focal or multifocal, cutaneous and/or extracutaneous, isolated or associated to other anomalies. They can occur anywhere in the body, involving the skin, oral and genital mucosae, intestinal tract, brain, liver, and lungs. Vascular anomalies of the male genitalia are uncommon and frequently misdiagnosed. The lesions grow slowly with age and may sometimes complicate by swelling, thrombi, calcification, functional damage, and pain. In addition, they may have an important psychological impact on the patient because of bleeding and psychological distress. The diagnosis is based on clinical history and physical examination, confirmed through Color Doppler Ultrasound (CDUS), and histology is helpful in few cases. Abdominal ultrasound (US) and/or Magnetic Resonance Imaging (MRI) are indicated to check associated anomalies. Genetic testing is requested if lesions are multiple, spread, multi-systemic, or associated to other anomalies.

Herein, we describe 3 children with glans VMs referred to our multidisciplinary paediatric centre of vascular anomalies.

Case 1

A 6-year-old boy presented with a history of dark colored bulking lesion on the left side of glans since the age of 3 years. No history of trauma or urinary dysfunction was reported. The clinical exam revealed a small bluish soft nodule, compressible nonpulsatile, and 2 tortuous vessels on the glans, 1 on the ventral left side of the penis, and the other one close to the urethral meatus (Fig. 1A). The foreskin was healthy, without ulceration or bleeding. CDUS confirmed the presence of a 5 mm diameter lesion on the left side of the glans near the external urethral meatus, with slow-flow signals. Abdominal and pelvic US were negative. Microsurgical excision of the VM with glanuloplasty and urethral meatoplasty was performed using a tourniquet and the anatomical plane between the lesion and the spongiosum tissue was easily defined during surgery. Histology and immunohistochemistry (IHC) confirmed the clinical diagnosis of VM. Postoperative course was unremarkable and Foley catheter was removed at postoperative day 2. Follow-up at 12-16 months did not show symptoms of residual or recurrent lesions. Cosmetic result was satisfactory, with minimal surgical scarring without functional sequelae.

Case 2

An 8-year-old boy presented with a 8 x 6 mm bluish soft oval nodule involving both sides of glans and the external urinary meatus since birth. The parents reported a progressive growth of the lesion, with recurrent episodes of urethral bleeding in the last 2 months. CDUS documented irregular and enlarged veins on the glans surface, with slow-flow signal (Fig. 2A). VM diagnosis was suspected and
abdomino-pelvic MRI showed urethral involvement, without associated anomalies (Fig. 2B-D). Therefore, surgical treatment was suggested by our team. Urethrocystoscopy showed a submucosal vascular defect on the left side of the distal urethra, probably cause of the recurrent urethral bleeding, which was successfully treated by low energy (5 joule) holmium laser through 272 micron fiber. Three months later, no more urethral bleeding was reported. Thus, a new urethroscopy proved the regression of the urethral involvement and a complete surgical excision of the glanular lesion was then performed under tourniquet. Histology and IHC were consistent with VM. Postoperative course was eventfulness and Foley catheter was removed at postoperative day 2. Follow-up at 12-16 months did not show symptoms of residual or recurrent lesions. Cosmetic result was satisfactory and urinary stream was adequate.

Case 3
A 5-year-old boy manifested an asymptomatic 6 × 5 mm bluish soft compressible, nonpulsatile nodule on the left side of the penile glans, growing progressively from 2 years of age. The CDUS confirmed slow-flow malformation, compatible with VM. Abdomino-pelvic US was negative. At surgery, a clear anatomical plan was found to dissect the VM from the spongiosum tissue of the glans. Moreover, modeling glansplasty was accomplished, using a tourniquet, in order to improve cosmetic result after tissue ablation (Fig. 3A-C). VM was confirmed by histology and IHC. Postoperative course was unremarkable and Foley catheter was removed at postoperative day 2. Follow-up at 12-16 months did not show symptoms of residual or recurrent lesions. Cosmetic result was satisfactory.

DISCUSSION
Many paediatric glans’ disorders are described in literature. Papali et al, reported 142 cases that include dermatological (16%), infectious (14%), cystic (44%), vascular (24%), and neurological lesions (2%).7 VMs involving the male genitalia are rare, with a reported prevalence of approximately 1.5%.5,8 Clinical features are characterized by bluish soft, compressible, and nonpulsatile mass, with occasional intralesional calcific nodules, or with enlarged and tortuous veins.4 CDUS is the primary exam, showing low-flow speed blood supply. Moreover, if the lesion is symptomatic, multicentric, or large, MRI should be performed to investigate the extension of the malformation and check the presence of associated anomalies, such as intestinal involvement.4,6 If recurrent episodes of thrombosis are described, thrombophilia must be ruled out.4

Our patients presented isolated and well-defined VM on the glans, without local complication, except in patient 2, who presented bleeding episodes due to urethral involvement. Abdomino-pelvic US performed in all patients did not reveal associated anomalies Pelvic MRI was utilized only on the symptomatic patient and was negative for intra-abdominal involvement. Notably, recurrent thrombosis, symptoms, functional damage, and cosmetic

Figure 1. (A-B) The clinical examination showed a bluish soft oval nodule involving the glans in patient 1(A). Successful result after treatment by complete surgical excision (B). (Color version available online.)
concerns are all indications for treatment of VMs. Our patients had small lesions, only 1 out of 3 was symptomatic. All of them were treated in order to prevent traumatic bleeding episodes that could appear and/or increase at puberty and adolescence, and to eliminate the risk of psychological discomfort due to cosmetic involvement at the site of the malformation.

Genital VMs treatment is challenging. There are no standardized therapies, even if several options are reported in the literature. Sclerotherapy, laser, or surgical excisions are the treatment of choice, separately, or combined. Surgical excision remains a valid treatment option in patients presenting with small, localized, penile, or genital lesions. Complications, including bleeding and scarring, can be avoided with meticulous surgical technique and good patient selection. Laser therapy is a good alternative with generally satisfactory results, except possible residual scarring. Sclerotherapy is reported as effective, with lower risk than surgery and fewer problems with scarring, it could also be performed before surgery. The limits of this technique are: the necessity of multiple sessions in general anaesthesia, the difficulty to remove completely the malformation and the impossibility to perform histology and immuno-histochemistry. Some authors reported their successful experience with sclerotherapy, treating small VMs of the glans using low concentration of pingyangmycin combined with lidocaine and dexamethasone. In our opinion, according with other authors, small and localized VMs on the glans may be completely removed by surgery with good cosmetic results, limiting the risk of recurrence and reducing the number of general anaesthesia. Surgical excision allows confirming the diagnosis through histopathology including IHC, and genetic testing if required. Laser may be indicated in particular conditions as in our patient 2, in which laser treatment by urethroscopy was effective to solve the urethral extension of the VM. As second step at 3 months interval time, complete surgical excision was accomplished and glanular and urethral repair, based on the principles of bulbar elongation with meatal advancement described by Turner Warwick, has been successfully performed.

Figure 2. (A-D) CDUS and MRI in patient 2. Color-Doppler ultrasound images of the penis on axial plane showing on the surface of the glans slightly enlarged dysplastic vessels with low venous flow (A) and absence of arteriovenous shunts. Dimensions of VM were approximately $7 \times 5$ mm. Fat-saturated magnetic resonance images of the abdomen and pelvis both on axial T2-weighted sections (B) and on axial (C) and sagittal (D) postcontrast T1-weighted scans confirmed the tortuous hyperintense dysplastic venous ectasia of the glans penis (arrows). Particularly, the distal penile urethra was involved by the VM (D, arrow). No abnormalities were detected within the abdomen and pelvis. (Color version available online.)
In our experience, complete surgical removal of the VM has been successfully performed. Histology of the removed specimen provided definitive diagnosis with identification of the involved vessels through IHC. Unfortunately, such good surgical results are limited to small and localized VMs. If the lesions are extended and widespread, causing severe complications, standard surgical approaches, or laser treatments are not suggested and off-label medical therapies may be available.13

The timing for treatment of glanular VMs is not well-defined in literature. Several factors are involved, such as entity and site of the lesion, patient age, clinical symptoms, psychological impact, and possible risk of recurrences after treatment. If there are no functional or anatomical complications during infancy, it could be prudent to delay the treatment until structures are larger, but we agree with Kulungowski et al8 to correct VM before puberty, in order to prevent psychological concerns and bleeding episodes. It is well-assessed that VM are anxiety provoking to both the parents and their young patients, starting from paediatric and prepubertal age.

In conclusion, location and extent of penile VMs are critical to decide the best management option. Our experience suggests that surgical excision of penile VMs is a valid and definitive treatment in selected patients, with low complication risk and it represents a positive alternative to other therapeutic options as sclerotherapy, embolization, or medical therapy. We suggest to solve selected cases of glanular VMs in paediatric age patients.

References
1. ISSVA Classification of Vascular Anomalies ©2018International society for the study of vascular anomaliesAvailable at “issva.org/classification”.

Figure 3. (A-C) Histology and immunohistochemistry (IHC) findings in patient 2. Well-circumscribed sub-cutaneous medium-sized vascular lesion, with thin muscular wall venous structures. Margins were free of lesion. Scattered small vessels are present inside and at the periphery of the lesion (H&E stain, magnification 4×) (A). CD31 strongly positive diffuse endothelial cells, both in normal subepithelial and in deep malformative vessels (magnification 4×) (B). Venous malformation shows D2–40 negative endothelial cells, while small subepithelial lymphatic vessels are positive (magnification 4×) (C). (Color version available online.)

