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Surgical management of low flow vascular malformations

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Abstract

Background: Percutaneous treatment has been widely used in low flow vascular malformations. However, surgery still has an important role in the management of these patients.

Objective: The aim of this study is to assess the indications for surgery in low flow vascular malformations, as well as the safety, efficacy, and recurrence rate.

Patients and Methods: A total of 33 patients with low flow vascular malformations were enrolled in the study. Duplex ultrasonography and magnetic resonant angiography was performed in all the cases. Selection criteria included significant soft tissue component, localized accessible lesions, suspicion of malignancy, persistent embryonic veins, residual lesions after sclerotherapy, and failure or development of complications of sclerotherapy.

Results: All the selected patients underwent complete surgical excision. Histopathological examination confirmed the preoperative diagnosis and excluded malignancy in all the patients. One patient developed postoperative bleeding that was managed by external compression and another patient developed necrosis of the edges of skin flaps that was managed by dressing. No recurrence was detected.

Conclusion: Surgical excision of low flow vascular malformations is a valid option in selected patients.

Keywords: Percutaneous treatment, vascular malformations, surgical management, surgical excision

Introduction

Vascular malformations represent a localized defect in vascular morphogenesis. They are present at birth but may not be discovered before childhood or adulthood. These congenital lesions increase in size proportionally with the growth of the body, do not regress spontaneously, and may show rapid progression in response to hormones or trauma^[1].

Based on the presence or absence of arterial communication, the lesions can be classified into high flow or low flow respectively. Low flow vascular malformations include venous malformations (VMs), lymphatic malformations (LMs), and capillary malformations (CMs)^[2].

Patients with low flow vascular malformations usually present with cosmetic disfigurement, pain, swelling, and limitation of movement. Complications include bleeding, ulceration, and thrombosis^[3].

There are no established guidelines for management of vascular malformations and each patient should be managed on individual bases. The treatment plan should aim to achieve functional integrity, cosmetic satisfaction, relief of pain, prevention of complications, and avoidance of recurrence^[4].

Although sclerotherapy has been widely used in the management of low flow vascular malformations, surgery still has an important role. Surgical excision is preferred in patients with localized accessible lesions particularly in sensitive regions as eyelids, genitalia, or near important nerves. Certain types of venous malformations do not respond well to sclerotherapy as those with high soft tissue component, and fibro-adipose vascular anomaly (FAVA)^[5].

Complementary surgical excision may be required after sclerotherapy to remove residual or thrombosed lesions. Also, surgery can be an option in the management of persistent embryonic veins as lateral marginal vein^[6].

The aim of this study was to assess the indications, safety, and outcome of surgical management in a cohort of patients with low flow vascular malformations.

Patients and Methods

This study was a prospective clinical study that was carried out at the vascular surgery department, Tanta University Hospital, Egypt, on 33 patients with low flow vascular malformations. The research continued for two years from the beginning of April 2020 to the end of March 2022. Informed consent was taken from all patients or parents after a detailed description of the procedure before enrolment into the study. Approval by the ethical committee was obtained before initiating this study.

Studied population

Inclusion criteria were symptomatic low flow vascular malformations diagnosed clinically and by duplex ultrasound (DUS) and confirmed by contrast-enhanced MRI with the following indications: Significant soft tissue component, localized accessible lesions, suspicion of malignancy, and persistent embryonic veins. Complementary surgical excision was offered to patients with residual lesions after sclerotherapy, failure or development of complications of sclerotherapy. Exclusion criteria were non-surgically accessible lesions, or contraindications to general anaesthesia.

Preoperative evaluation

Besides history taking and clinical examination, preoperative DUS and contrast enhanced MRI were performed in all the cases. Laboratory investigations included CBC, coagulation profile, and renal functions. D-dimers test was ordered for patients with suspected intralesional thrombosis.

Technique

1. Preoperative duplex US marking was performed as the lesion may fade in supine position.
2. General anesthesia was used in children, while adults with localized lesions could receive local or regional anesthesia.
3. The choice of the incision was based on the site of the lesion. To achieve the best cosmetic results, incisions were made following Langer's lines. The skin flaps were made with adequate thickness to avoid skin necrosis.
4. The neurovascular structures were identified and protected before the resection of the mass. Careful dissection in the plane between the vascular malformation and the surrounding subcutaneous tissue or muscles was the optimal surgical strategy. Loop magnification was used when needed.
5. After removal, careful hemostasis was done by electrocautery, hemostatic sutures, or ligation. Suction drains were used in all the patients.
6. The excised specimen was sent to histopathological examination.
7. An elastic compression bandage was applied. The skin sutures were removed after 2 weeks in the extremities and 6 days in the face.

Follow-up

Patients were follow up at 2 to detect any complications and

residual lesions. Follow-up is then continued every 12 weeks for 1 year for detection of recurrence.

Results

A total of 33 patients with low flow vascular malformations were included in this study. All the excised lesions were venous malformations. Indications of surgical excision included significant soft tissue component in 6 patients, localized accessible lesion in 3 patients, thrombosed lesions in 3 patients, residual lesion after sclerotherapy in one patient, intramuscular calcified lesion with suspicion of malignancy in one patient, and lateral marginal vein in one lesion. Details of the patients' demographic data are described in table 1:

Table 1: The demographic and clinical data of the treated group

Age (yr.)		
Min. – Max.	2 – 38	
Mean ± SD.	15.7 ± 10.5	
Mode	12	
	No.	%
Gender		
Male	16	48.48
Female	17	51.52
Location		
Lower Limb	12	36.36
Upper Limb	10	30.30
Head and Neck	6	18.18
Trunk	4	12.12
Genitalia	1	3.03
Presentation		
Disfigurement	28	84.84
Pain	23	69.69
Limitation of activity	8	24.24
Size (Cm³)		
Min. – Max.	2 – 700	
Mean ± SD.	74 ± 182.13	
Mode	6	

Postoperative complications

One patient with a large angioliipoma in the lateral chest wall and back measuring 700 cc developed postoperative bleeding in the drain in the form of 500 ml of blood over 24 hours. This was managed by external compression with elastoplast. Monitoring was continued until the bleeding stopped then the drain was removed. No blood transfusion was needed. Another patient developed necrosis of the edges of skin flaps that was managed by local dressing until complete healing was achieved. No recurrence was detected in the treated patients within the follow-up duration.

Histopathological analysis

All the excised specimens were sent for pathological analysis. The preoperative diagnosis was confirmed in all the patients. No malignancy was detected in the excised lesions. In addition, the resection margins were pathology-free in all the cases.

Case presentation

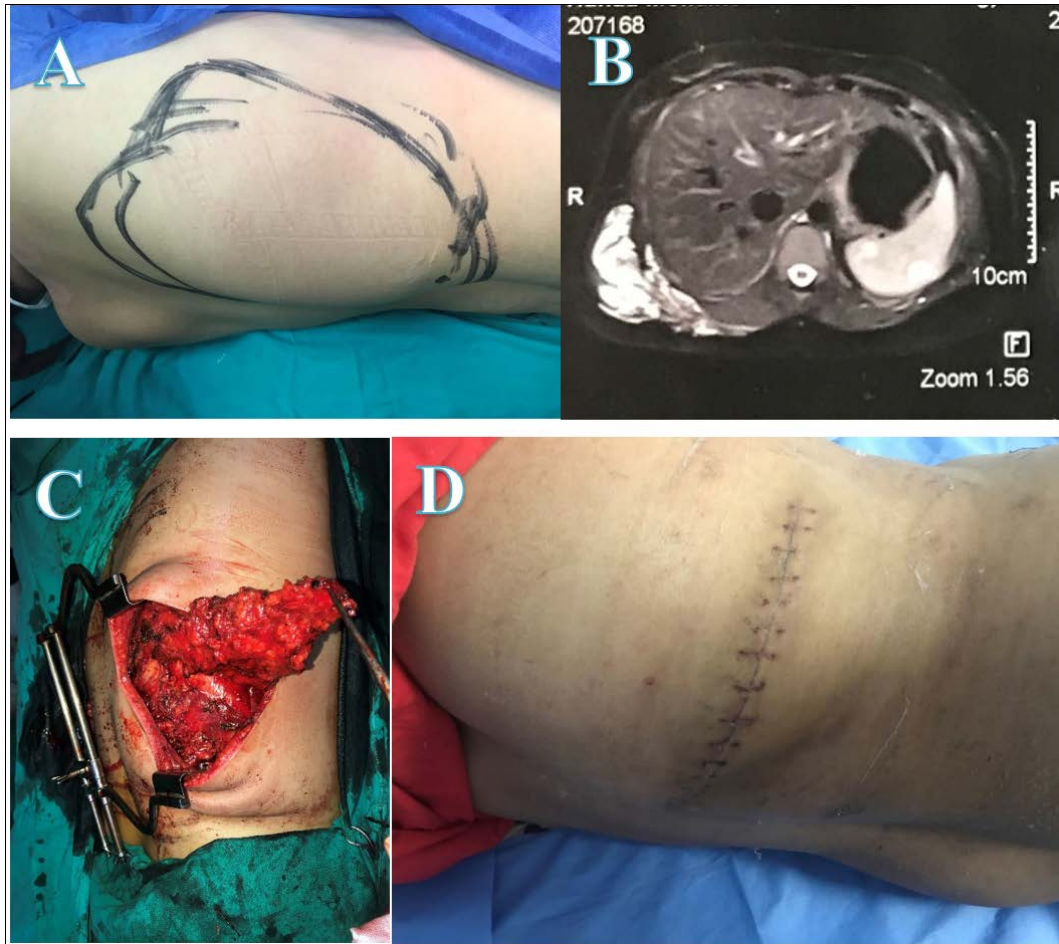


Fig 1: Female patient aged 38 years old presented with a large painful mass in the right side of the chest and back (A). Contrast enhanced MRI angiography showed high signal intensity on T2 and delayed post-contrast enhancement suggestive of venous malformation (B). Significant fatty element was observed in the images denoting poor response to sclerotherapy. Surgical excision was done through a transverse incision with caution to preserve the long thoracic nerve (C). At follow-up, the patient had complete wound healing and was pain free after the excision of the mass (D).



Fig 2: Male patient presented with a venous malformation in the lower eyelid of the left eye that caused cosmetic disfigurement (A). Complete surgical excision of the lesion was done (B). The postoperative appearance showing complete removal of the lesion with minimal scar (C)

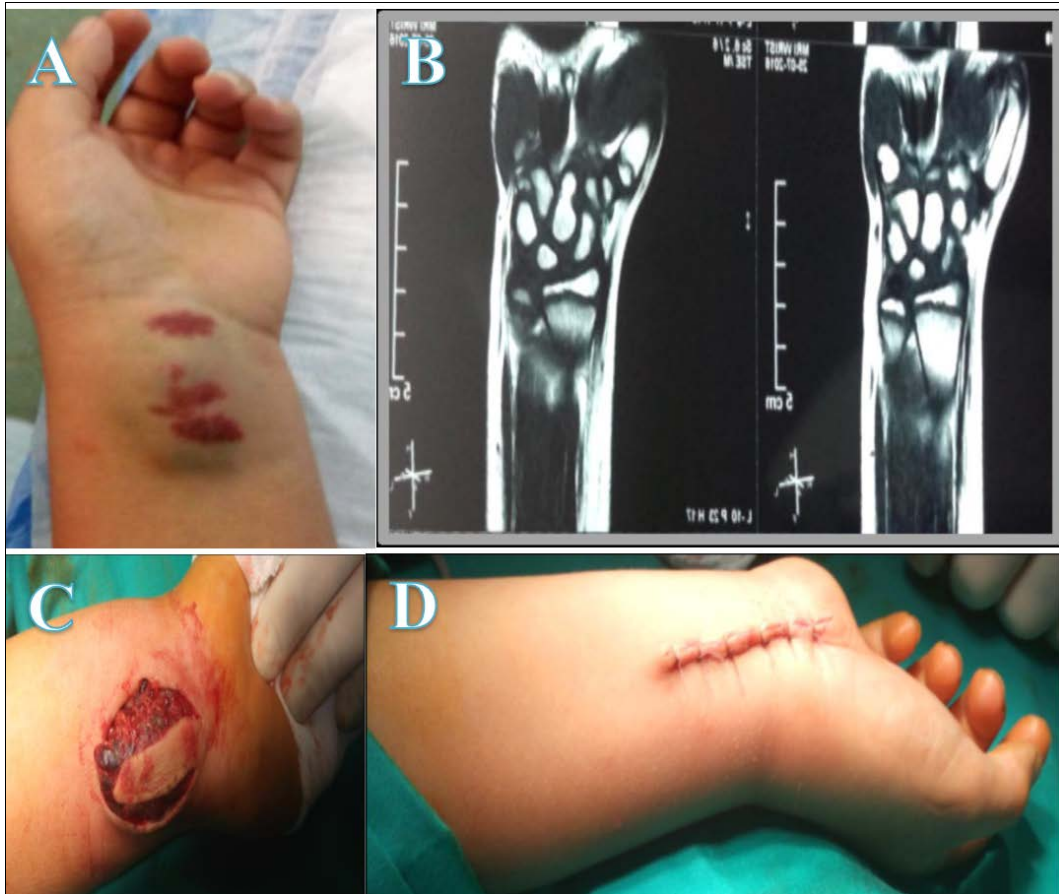


Fig 3: A child with low flow vascular malformation in the right wrist joint (A). MR angiography showed diffuse and multiple low flow vascular lesions with no arterial supply (B). Complete surgical excision with a part of the overlying involved skin (C). The final postoperative appearance after complete excision (D).

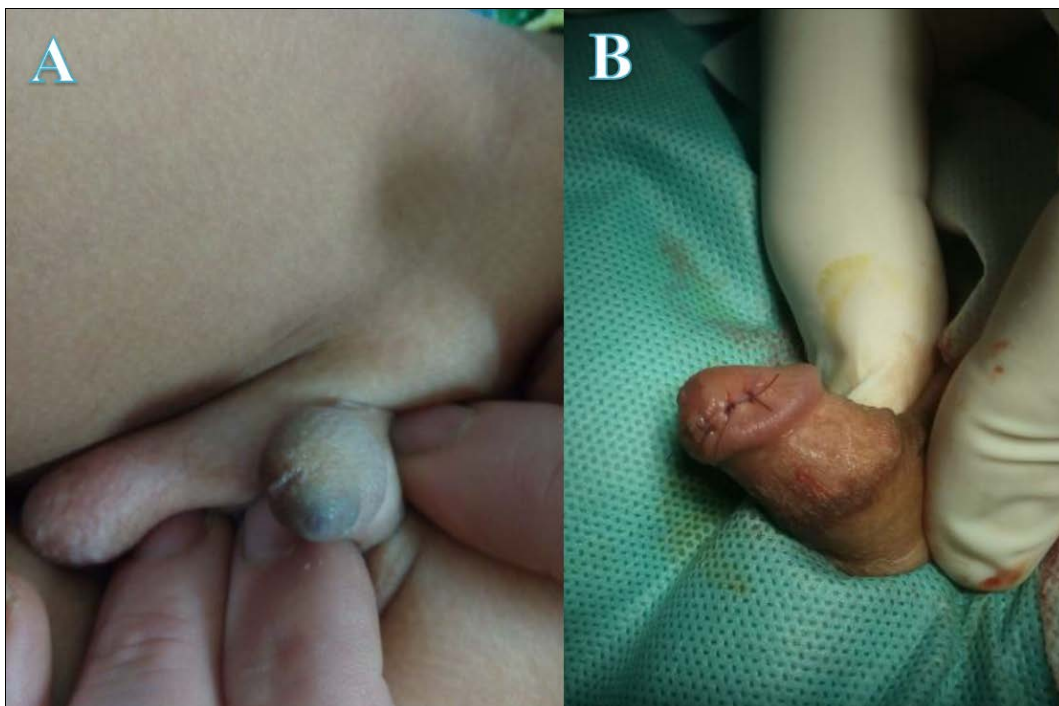


Fig 4: A venous malformation in the penile glans (A). The lesion was completely excised (B).

Discussion

The proper management of low flow vascular malformations requires a multidisciplinary team including vascular, plastic, and orthopaedic surgeons, with radiologists and anaesthetists. This study aimed to evaluate the indications, safety, techniques, and

efficacy of surgical excision of these lesions. There is no typical pattern for this condition. It has a wide range of symptoms and the patients come in different ages with any body region affected. Therefore, the treatment should be individualized to each patient. In this study, patients were treated

by surgical excision based on specific selection criteria as the type, extent, compressibility, and soft tissue component. This is similar to Manoli *et al* who allocated 39 patients with VMs to either surgery or sclerotherapy according to a predefined algorithm. However, their algorithm was based only on the extent of the lesion (circumscribed lesions underwent surgical excision, while extensive lesions underwent sclerotherapy) [7].

One of the main advantages of surgical excision of vascular malformations is that it allows histopathological examination to exclude malignancy. This is important because malformations and soft tissue tumors can have similar clinical and imaging criteria. Lee HN *et al* reported four cases of soft tissue tumors that were initially misdiagnosed as arteriovenous malformations and treated with ethanol embolotherapy [8].

Histopathological analysis for all the patients in this showed free resection margins and no features of malignancy. Frozen section biopsy was not used in this study. In earlier studies, frozen section biopsy was found to be unreliable in this setting [9].

In this study, surgery was offered to selected patients with low flow vascular malformations as mentioned previously. In contrast, Steiner *et al* treated all the patients with VMs by surgical excision. They reported a high rate of patients' satisfaction. However, surgical complications as nerve injury, hematoma, and wound dehiscence occurred in 10% of the patients [10].

In sensitive regions as genitalia or eyelids, surgical excision may provide better results than sclerotherapy due to lower incidence of postoperative edema, less recurrence, and the lesions are usually localized and surgically accessible. Also, surgery avoid the risk of exposure to radiation in the genitalia with its associated hazardous effects. This is consistent with Kaufman *et al.* who treated penile venous malformation by surgical excision [11].

Not all vascular surgeons have experience in endovascular management of vascular malformations. Moreover, the equipment and facilities required for endovascular intervention is not always available. Therefore, the skills of surgical management of these lesions are vital and may be life saving [12].

Conclusion

With proper selection of patients, surgical excision of low flow vascular malformations can achieve satisfactory results in the treatment of low flow vascular malformations with low incidence of recurrence. Patients with significant soft tissue component, localized accessible lesions, suspicion of malignancy, persistent embryonic veins. And residual lesions after sclerotherapy, are better treated by surgery.

Conflict of Interest

Not available

Financial Support

Not available

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