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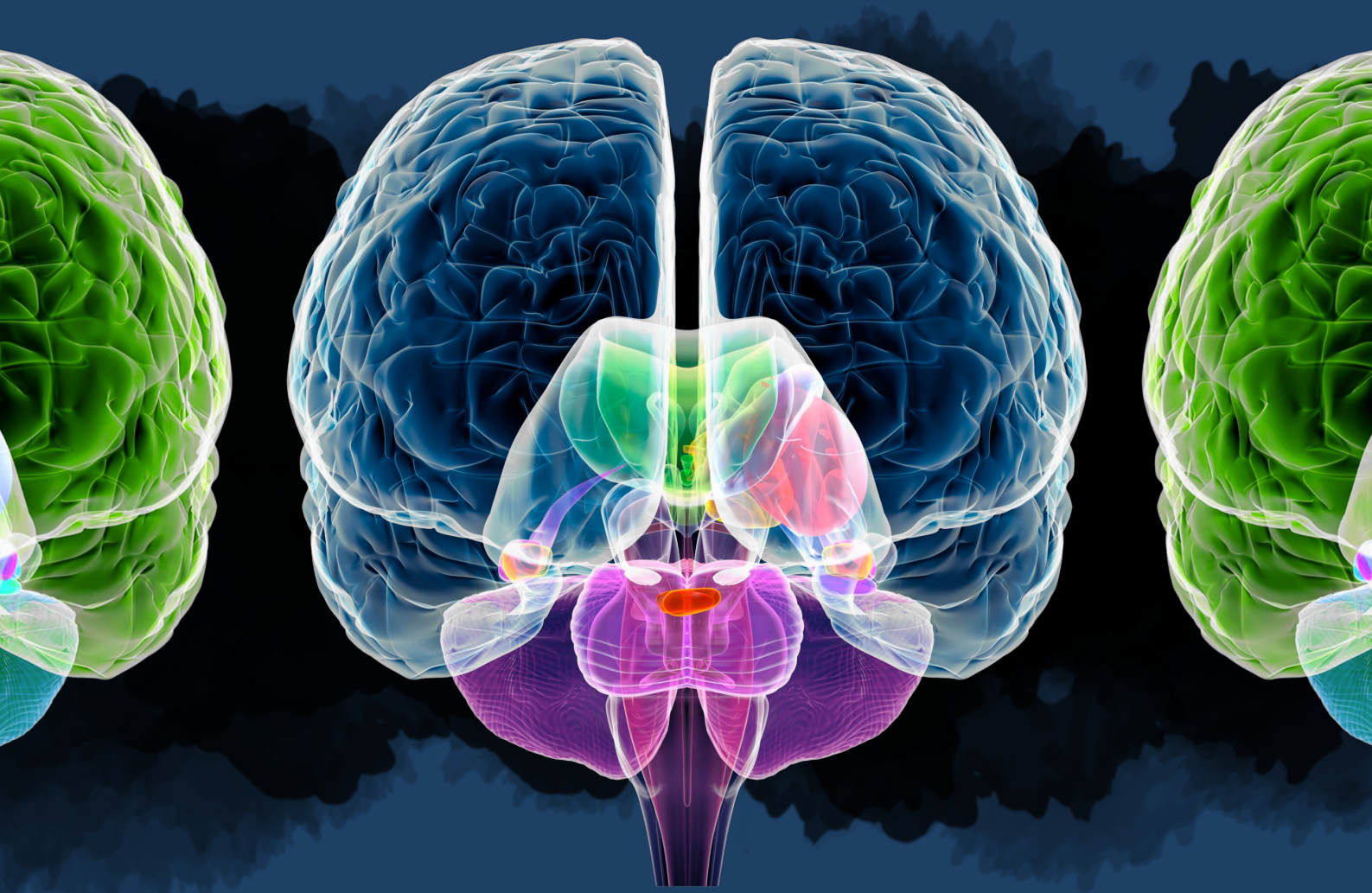

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A MULTIDISCIPLINARY APPROACH TO TREATMENT OF HIGH FLOW HEAD AND NECK ARTERIOVENOUS MALFORMATIONS: SINGLE CENTRE EXPERIENCE IN 7 COMPLEX CASES

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ABSTRACT

Introduction: The objective of this work is to determine the role of a multidisciplinary approach in treating the complex high flow head and neck arteriovenous malformations (AVMs), involving radiologists and plastic surgeons for the best possible outcomes.

Methods: Between 2018 and 2020, the investigators conducted a retrospective analysis on seven patients with high-flow head and neck AVMs who received treatment at a tertiary care facility. Age at first diagnosis, presenting features, prior therapies, endovascular treatment, surgical treatment, and therapeutic outcomes were all recorded. A comparison of pre-and post-procedure pictures was made to assess the clinical outcomes for all patients.

Results: Seven patients with complex high flow head and neck AVMs were jointly managed by performing plastic surgery and interventional radiology. There were male and female, with an average age of 24 years. Each patient underwent embolization followed by surgical resection within a 24-hour window of up to 72 hours. In six out of seven patients, the lesion was removed therapeutically, whereas the seventh required palliative resection. Only one patient, there was a minor wound healing difficulty able to be treated with dressings.

Conclusion: The results revealed that embolization alone is not effective to reduce the adverse effects. Incomplete removal of AVM showed the same effect as incomplete removal of a tumour. It may not improve symptoms and may worsen the recurrence, thus multi-modality approach is beneficial. A multidisciplinary approach, aided by the interventional radiologist and enable plastic surgeons to remove the high-flow AVMs effectively.

Keywords: Arteriovenous malformation; Embolization; High flow; Multidisciplinary; Plastic surgery

ABBREVIATIONS

AVM: Arteriovenous Malformation
AP: Antero-posterior
CT: Computed Tomography
DSA: Digital Subtraction Angiography
DSMO: Dimethyl Sulfoxide
ECA: External Carotid Artery
EJV: External Jugular Vein

EVT: Endovascular Therapy
H&N: Head and Neck
ICA: Internal Carotid Artery
ISSVA: International Society for the Study of Vascular Anomalies
MRI: Magnetic Resonant Imaging
MDM: Multidisciplinary Meeting
NBCA: N Butyl Cyanoacrylate
OA: Occipital Artery
PAA: Posterior Auricular Artery
PVA: Polyvinyl Alcohol Particles
PAV: Posterior Auricular Vein
STA: Superficial Temporal Artery
VA: Vertebral Artery

INTRODUCTION

Head and neck AVMS, according to the International Society for the Study of Vascular Anomalies (ISSVA), are high-flow vascular malformations that are rare and thought to be congenital. (1) Trauma frequently discloses dormant AVMs. Curative surgical treatment results in the best outcome if treated in the early stage of the disease, and the advanced stage for conservative treatment remains the only viable option in most cases. (2) However, surgical options are still feasible in advanced, diffuse lesions.

Surgical approaches are associated with a greater morbidity rate and a strong probability of recurrence, especially diffuse lesion. (2) Despite surgical excision and 98% embolization, 81% of peripheral AVM patients recurred based on a study of 272 individuals with head and neck AVMs. Nidus leftovers were a significant component in recurrence, and their complicated morphology and considerable vascular collateralization were frequently implicated. (3) Thus, complete removal of the nidus is of utmost importance, either radical surgical resection or ablation.

This radical approach may include normal structures in numerous tissue planes, with the potential for deformity and functional impairment (3). A single therapeutic modality is unlikely to result in a significant long-term improvement, hence, a multimodal treatment plan is likely to give a better result (4).

The ideal way to treat head and neck AVMs is with a multidisciplinary strategy that includes endovascular embolization as well as surgical excision. However, due to the infrequent cases, current experience is limited to tiny case series and isolated incident reports.

This review of 7 cases highlights the short and medium-term treatment outcomes from a multidisciplinary approach for the case of complex head and neck AVMs, from a single centre.

METHODS

All patients with high flow complex head and neck AVMs were confirmed diagnosis based on angiography. For this case study, a multidisciplinary team was made up of plastic surgeons, neuroradiologists, and neurosurgeons. They evaluated all of the patients' clinical and imaging records and agreed with the diagnosis of AVM.

All of the patients had digital subtraction angiography with selective opacification of both ICAs and ECAs in AP and lateral projections emphasized on the head and neck region. In all cases, endovascular therapy was performed. The multidisciplinary team reviewed the donor site healing in terms of flap survival and graft. In selected cases, a follow-up CT angiogram or MRI was performed in order to have a more detailed assessment. Informed consent was obtained for all cases to acquire both photographs of pre-procedure and post-procedure.

RESULTS

In all seven patients, five females and two maleswith the age ranges from 16 to 28 years old. Of all patients, the endovascular treatments were performed within 24 to 72 hours prior to surgery. In cases that underwent multistage embolization, excision was performed after the last embolization session. Four out of all patients, immediate post-embolization angiography revealed the full angiographic exclusion of the AVM.

AVMs were found on the scalp and forehead in four of the patients; the pinna and postauricular region were found in the first case, and the pinna and scalp were noticed in the seventh case. Transarterial embolization was performed on six patients, while one patient was treated percutaneously via direct puncture. Co-polymer embolic materials (Squid 18) were used in three cases, while n-BCA was used in the other four.

Four out of seven patients had previous surgery, while one of the patients had underwent two surgical procedures and another two patients never had any prior treatment. None had any experience with the endovascular procedure. In all cases, follow-up was done for a period of 1 to 3 years. Patients were

monitored clinically based on the multidisciplinary team's clinical assessment and subjective experiences. There were no recurrences or persistence of symptoms in all seven cases after 3 years of follow-up. Six patients were cured and one had satisfactory results. One patient experienced minor local pain at the AVM site, which was relieved with painkillers.

Endovascular Technique

In all cases, we choose the right femoral artery approach with a 6 Fr femoral sheath and a 6 Fr guiding catheter. Microcatheters were selected based on the difficulty of nidal access and embolic material preferences. For copolymer embolic materials of Squid 18 was used for the approach of injection of plug and push under intermittent fluoroscopy, whereas n-BCA was used for the flow-aided approach. The microcatheter was primed with a 5% dextrose solution for n-BCA, and the n-BCA: lipiodol dilution ranged from 1:1 (50 per cent dilution) to 1:5 (16 per cent dilution). Using the same method, different feeders were embolized independently. In the direct percutaneous approach, the lesion was directly punctured with a 16-gauge cannula under roadmap guidance. Temporary occlusion was performed by using the cookie-cutter technique and the diluted n-BCA with lipiodol was injected into the venous pouch.

Both kinds of microcatheters (detachable tip and non-detachable tip) can be used for glue embolization. Usually, the glue is mixed together with an oily contrast agent (ethiodol) that prolongs the polymerization time, increases viscosity, and makes the mixture radiopaque. The ratio of glue to oil can be changed and generally ranges from 1:1 up to 5:1, and the dilution of glue depends on the amount of oil. The ratio is changed depending on the flow characteristics of the AVM. The mixture of oil and n-BCA is comparatively unstable and often hardens spontaneously after 15 minutes. Therefore, the microcatheter must be rinsed with 5% dextrose in a water solution before injecting an amount of glue. The glue is introduced using the push technique and the microcatheter is placed in the wedge position close to the nidus. Care should be taken to preserve the main vascular trunk leading to the malformation as subsequent treatment will likely be required. A control angiogram is always obtained to verify the complete closure of the nidus.

In a single patient, a direct percutaneous approach was chosen for embolization because a ligitation of the external carotid artery ligation was performed during a previous surgery and navigation to the nidus was difficult. After selective transarterial angiogram, the lesion was punctured directly with a 16-gage cannula under roadmap guidance. Temporary occlusion was achieved by using the cookie-cutter technique and a mixture of glue and lipiodol administered in a venous pouch. Angiogram after embolization angiogram showed complete occlusion of the scalp AVM. In arteriovenous malformations of the head and neck, ICA feeders were not able to embolize them to avoid neurological complications (**Figure 1**).

Surgical Technique

Surgery was performed in all seven patients within 24 to 72 hours after superselective embolization. All cases underwent elective surgery after the necessary optimization. Blood grouping and crossmatching were performed in all patients. After intubation, patients were placed in the supine, prone, or lateral position, depending on the location of the AVM, with the head end elevated 30 degrees above the level of the heart. In all seven patients, an attempt was made to remove the entire AVM including the overlying skin and subcutaneous tissue, to reduce the recurrence. Therefore, it should be noted that the primary closure was achieved in one patient during the study, while a cross-linked split-thickness skin graft was used for resurfacing in the other five patients, and a temporoparietal fascia flap with cross-linked split-thickness skin graft that was used in another patient. In all patients, a conforming dressing was applied and the head was elevated after surgery and closely monitored for rebleeding. Two patients with primary closure and flap plus graft had suction drainage. The first postoperative dressing was changed on the fifth day, followed by new dressings every three days. The staples placed over the skin graft were removed on the eighth postoperative day.

Illustrative Cases

Case 1

A 16-year-old female patient presented with a pulsatile, boggy swelling of the left auricle and scalp that gradually increased in size. History included headache, tinnitus, and recurrent bleeding from minor trauma, which was controlled by local pressure and dressings. Clinical examination revealed that the swelling

involved the entire left auricle and postauricular area, as well as the left temporoparietal, vertex, and occipital scalp regions. The swelling was pulsatile and diffusely serpiginous, with palpable tingling and audible bruit at multiple sites. It was compressible and regressible with a recovery time of less than one second. The skin was hyperpigmented and hypopigmented, which was due to healed ulcerations. The patient has undergone surgery at a peripheral hospital 6 years ago. The scar from the previous surgery was visible on the left side of the neck, and the surgical notes showed ligation of the left external carotid artery. However, the patient noted a rapid increase in swelling after surgery.

An angiographic examination was performed before deciding on the final treatment plan. DSA showed a fistulous auricular AVM fed by the left posterior auricular artery and the muscular branch of the right vertebral artery draining into the external jugular vein. The left vertebral artery was ligated at the previous operation. The AVM of the scalp was fed by the OA and STA from the right carotid system and drained into the right parieto-occipital vein ecstata. A staged treatment was planned to keep in mind the size of the scalp AVM (occupying nearly two-thirds of the scalp) and two anatomic structures are commonly known as the scalp and auricle. Pre-surgical embolization of the scalp AVM was decided as the first step, followed by surgical excision within 72 hours. After angiography, the dilated venous sac of the scalp AVM was accessed percutaneously with a 16-G cannula under roadmap guidance by injection into the external carotid artery. The cannula dead space was injected with 10% dextrose water and the vein was sealed with glue (50% concentration). Temporary flow arrest was achieved by manual cookie-cutter compression (**Figure 2** and **Figure 3**).

Embolization was observed within 72 hours after embolization. Actually, proximal vascular control of the ipsilateral external carotid artery should be performed to avoid bleeding catastrophe, but this is not possible due to prior ligation of the ECA in some peripheral hospitals. The patient was placed in the prone position with the head elevated after endotracheal intubation. An inert S-shaped incision was made that encompassed the AVM of the scalp and extended vertically into the left preauricular region. Numerous large, tortuous, dilated, thin-walled fragile vessels were encountered, clipped and divided distally, followed by dissection in the subcallosal plane. Ipsilateral and contralateral occipital vessels, as well as ipsilateral STA, were transected after the application of Lega clips. Nearly two-thirds of the affected scalp AVM was excised, and the wound was closed by applying the mesh-like split-thickness skin graft. The patient recovered postoperatively without problems, except for minor wound healing problems and was treated with topical ointments and dressings.

Case 2

A 28-year-old man presented to our institution with a pulsatile swelling on the right forehead that has been present since childhood. The history included headache, palpitations, and pulsatile swelling of the periorbital vessels as well as redness of the right eye and periorbital region with visual disturbance. Clinical examination revealed a 15 cm × 8 cm × 4.5 cm oval swelling in the right frontal half with visible pulsations and audible bruit. There were multiple hypopigmented scars over the swelling. There were markedly dilated tortuous frontal branches on both sides from STA, which also had visible pulsations. The angiogram showed a hypertrophied right STA with gross dilatation and tortuous course of its frontal branch draining into the nidus along its entire length. The draining superficial scalp veins were also markedly dilated. Injection into the right internal carotid artery revealed additional supply from the supratrochlear and supraorbital branches of the right OA. Embolization via transarterial route was performed before surgery and the frontal branch of STA was embolized with glue. Feeds from the OA were not attempted for fear of reflux (**Figure 4**).

It was noted that the resection and reconstruction occurred within 24 hours after embolization. The patient was placed in the supine position with the head elevated. The frontal branches STA on both sides were ligated and transected as proximally as possible. Along the right edge of the AVM, a C-shaped incision with an upper extension of 4 cm was made in the scalp to expose and ligate of the one large feeder vessel. Complete excision of the AVM was performed with excision of the skin ellipse. Layered wound closure was performed over a suction drain, which was removed after 48 hours. The skin staples were removed on the tenth postoperative day. The patient recovered without complications.

Case 3

A 38-year-old man presented with pulsatile swelling of the entire right ear and a gradual increase in size of the right ear (macrotia). There was a history of haemorrhage from minor trauma, which was treated by local compression. Clinically, the malformation involved the entire external ear and extended from the root of the spiral rim to the earlobe and

postauricular region with discolouration of the overlying skin. The swelling was compressible and resolved in less than two seconds. Tingling was easily palpable and a continuous bruit was heard on auscultation. The external auditory canal and tympanic membrane were unremarkable. The clinical diagnosis of high-flow arteriovenous malformation was made on the basis of history and examination by a multidisciplinary team.

Angiography revealed a high-flow AVM in the auricle, draining into the right PAA and OA, and draining into PAV and EJV. However, additional supply through the internal carotid system was not detected. At the same time, preoperative embolization was decided to reduce vascularity before surgical excision. Transarterial embolization was performed by PAA with 70 % glue, and almost 75% of the AVM were embolized. Surgery was scheduled 48 hours after embolization.

The patient was placed in the supine position with the head turned to the left side. Ipsilateral proximal control of the ECA was taken. The incision was made in the postauricular region and the posterior auricular artery was ligated and divided. The entire lesion on the posterior side was resected along with the skin, subcutaneous tissue, and perichondrium, preserving the cartilage of the auricle. The malformation in the concha was excised via the anterior approach. The length of the spiral rim was reduced by a wedge excision, and the width of the ear was reduced by several small triangular excisions. Resurfacing of the exposed auricular cartilage was performed with an ipsilateral temporoparietal fascial flap and a split-thickness skin graft from the thigh. A suction drain was placed in the postauricular area and then a conforming dressing was applied (**Figure 5**)

DISCUSSION

Arteriovenous malformations are known to be vascular anomalies with high-flow and numerous low-resistance shunts that short-circuit the capillary bed. It enlarges not by cellular hyperplasia but by hemodynamic mechanisms. As a result, collateral formation is promoted, which in turn diverts regional blood flow from the periphery (4).

Arteriovenous malformations in the head and neck are much less common than intracranial AVMs. Rapid blood flow typically becomes evident in childhood. Puberty or trauma appears to trigger the expansion. Treatment of these lesions is based on clinical symptoms, which may vary depending on type, size, and location. Usually, they are cosmetic problems, pain, bleeding, or ulceration. Selective angiography is better suited to characterize the nidus, flow pattern, and micro- or macro-arteriovenous fistula before interventional therapy (5). Treatment of arteriovenous anomalies is generally known to be potentially dangerous, and sometimes the results are disappointing (4).

The therapeutic strategy consists of selective embolization combined with surgical ablation and reconstruction. The goal of preoperative embolization is primarily to reduce blood loss and facilitate surgical extirpation. It should be noted that the extent of resection should be reduced in this disease. Surgical excision should not be delayed for more than 72 hours after embolization, as the inflammatory process complicates surgical access, thus negating any hemostatic benefit (4).

Neither surgery nor embolization alone is the correct treatment. For this purpose, AVMs, in particular, must be ligated or proximal embolization of the feeding arteries must never be performed. Rapid recruitment of flow from the normal anastomosis of the head and neck region will then supply the nidus so that proximal arterial blockage will deny access for embolization. (5) All these limitations occurred in case No. 1, where proximal ligation of the ipsilateral ECA resulted in rapid recruitment of flow from the contralateral ECA. It is possible to take the proximal vessel control in the neck, which could have contributed to a reduction in operative time and blood loss.

Surgical ligation has been performed for decades as the only treatment modality for these lesions. However, proximal surgical ligation of the feeding arteries without resection is doomed to failure because it may exacerbate the condition by promoting the collateral formation and also removes a potential access channel for therapeutic embolization (4).

Scalp AVM should be excised largely to the pericranium, with primary closure of the defect by either skin grafting or scalp flaps. Simple capillary staining of the auricle may be the first warning sign of underlying AVM. Complete amputation of the ear and, if necessary, transection of the VII cranial nerve may be required. If excision is not completed in a timely manner, the AVM will re-expand and may encircle the skin graft or skin flap used for the reconstruction (4).

Endovascular therapy alone is not a treatment of choice to recommend such an event. H&N AVMs have such complex architecture and abundant natural arterial supply lesions on the face and scalp that treatment plans can become complicated. Therefore, a midline lesion is often supplied by bilateral external carotid arteries (ECAs) and usually has multiple draining veins. The development of microcatheter techniques has allowed the delivery of NBCA, PVA, and other embolic agents into the AVM nidus (6).

We have a multidisciplinary team at our institution that makes decision about vascular malformations of the head and neck. We have divided small H&N AVMs into two groups: those curable by embolization and those curable by surgical excision after embolization. Large AVMs are divided into two groups: either they can be cured by post-embolic excision or not. The latter group was treated with

embolization only for symptomatic relief. Our approach is summarized in **Table 1** (6).

A critical role of endovascular embolization in H&N AVMs is a palliative treatment for symptomatic relief and supportive treatment before surgical excision. This is especially true when larger malformations are involved. Embolization is the treatment of choice to control acute haemorrhagic events and is performed urgently as soon as the incident occurs. Ideally, surgery should be performed within 72 hours of embolization in order to minimize the risk of developing collateral supply and inflammation-related complications. This may be supported by the fact that excision must include the embolic material and thus the overall workup does not reduce the effective lesion size.

In H&N AVMs that have a large number of recruiting vessels that are not connected to the nidus (angiogenesis), care must be taken during embolization. Consequently, embolization must be performed directly on the nidus of the lesion without targeting the supplying arteries or collaterals, unless surgery is planned immediately thereafter. Therefore, anagenesis is unlikely with therapy directed to the nidus. Experience has shown that anagenesis is far more common in large AVMs where the nidus is more difficult to access. Anagenesis is normal even with incorrect management with proximal ligation.

Proximal ligation should not be performed if a patient has received proximal ligation before referral to us. In the case of our series, with two AVMs on the scalp and auricle, surgical ligation of the ECA and VA was previously performed. Thus, angiogenesis can occur within weeks to months after improper embolization. It is essential for the development of angiogenesis to involve the previously healthy tissue surrounding the AVM. This can be a serious problem if these vessels are fragile and bleed easily. Angiogenetic arteries are often difficult to reach by endovascular means and therefore, must be reached by surgical access (6).

Complications associated with extra-axial embolization include neurologic defects resulting from reflux of occlusive material into the intra-axial vessels supplying the brain. For example, cranial nerve palsies can be caused by obliteration of small branches of the external carotid artery that supply the peripheral cranial nerves. This can occur but is rare when minimized by the ability of angiography to accurately position the catheter and the incorrect use of embolic agents, and adequate knowledge of the malformation and architecture is a must (4).

At the other end of the spectrum, there are risks and complications that are relatively specific to cyanoacrylate adhesive (n-BCA) embolization. Among the more serious complications is intracerebral haemorrhage. Vascular perforation during microcatheter placement and delayed haemorrhage due to obstruction of venous outflow or increased blood pressure in a residual nidus or feeders are the main causes of such complications. Vascular perforation during microcatheter placement can be very risky and can easily occur by reducing the use of flow-directed microcatheters. The use of a metal guidewire with a flow-guiding catheter for advanced placement and navigation in the feeder of the AVM is a prerequisite for this common occurrence. However, it is important to be careful not to extend the guidewire beyond the catheter tip (8).

Large and diffuse high-flow H&N AVMs are the major obstacle. They are usually treated by transarterial embolization to control acute bleeding; these lesions may require various percutaneous and endovascular approaches. For lesions in the soft tissues of the face and scalp, manual compression of the draining veins at the time of embolic delivery may be beneficial, and the placement of a tourniquet has been shown in our experience to better distribute embolic material into the nidus and proximal draining veins. This tourniquet is left in place until the delivery of the embolic agent, in the case of n-BCA, until it solidifies (6).

Liquid embolic agents are increasingly used to treat AVM in the head and neck region. Thoughtful optimization of flow dynamics for penetration of nidal and AV fistulas during embolization of a dominant arterial branch is believed to be critical to success (7).

Direct puncture embolization is the other method used for preoperative devascularization of superficial craniofacial AVM with prominent venous pouches. It is comparable to the arterial Tans method. It may reduce the likelihood of incomplete embolization and therefore, results in later recruitment of new collateral feeders. Therefore, the effect is more dramatic and immediate, especially in symptom relief and intraoperative bleeding control. For cosmetic reasons, there is no additional risk of necrosis of the skin, the lesion can be resected without grafting. However, it is a definitive treatment when surgical resection is required in patients who do not desire bulging of a superficially palpable adhesive dressing (9).

A combined treatment approach is the right way to treat complex AVMs with high flow in the head and neck region.

Surgical excision with embolization or a combination of the two modalities has been used to treat AVMs. Evidence suggests that surgery with preoperative embolization followed by lesion removal offers the best chance of cure. Be that as it may, recurrent, relapsing, or quiescent lesions cannot be avoided regardless of treatment. It is a common finding regardless of the treatment modality, especially embolization for high blood flow arteriovenous malformations, which initially had a low value but is currently observed to have better outcomes than previously limited procedures. And now the results with embolic agents like Onyx. Close monitoring of malformations as in the treatment of malignancies is therefore necessary (10).

Table 1: Demographics, location, endovascular and surgical treatments of patients with high flow head and neck arteriovenous malformations

Patient	Age (year) /Gender	AVM Localization	Presenting Features	Feeding Arteries	Endovascular Treatment	Previous Surgery	Surgical Treatment	Complications and Follow Up
1	16/F	Pinna (L), scalp	Cosmetic reasons, pain, recurrent haemorrhage , bruit, tinnitis	Auricle AVM-L PAA , R VA (muscular branch) Scalp AVM- R OA , STA Venous drainage-auricle AVM drained into EJV Scalp AVM draining ectatic parieto occipital vein	Percutaneous route embolization of scalp AVM with Glue	1	Total resection of scalp AVM and reconstruction	Flap infection/1.5 years/no recurrence
2	38/M	Pinna (R)	Swelling, recurrent haemorrhage s, ulceration, bruit	R-PAA ,R-OA Venous Drainage - R- PAV, EJV	Transarterial embolization of arterial fedders with Glue	0	Total resection and reconstruction	Nil/1 year/no recurrence
3	35/F	Scalp	Swelling, recurrent haemorrhage , ulceration, pain, bruit	B/L OA ,STA Draining vein-Scalp veins	Transarterial embolization of right OA and STA with Glue	0	Excision and reconstruction	Nil/1.2 years/no recurrence
4	25/F	Pinna (R)	Cosmetic reasons, recuurent bleeding, pain, ulceration	R-PAA Draining vein-PAV & EJV	Transarterial embolization of right PAA with Squid 18	0	Excision and reconstruction	Persistant pain/1.5 years/no recurrence
5	28/M	Forehead	Cosmetic, recurrent episodes of bleeding on minor trauma, ulceration, bruit	Anterior branch of R -STA Supratrochlear and supraorbital branch of R-ICA Drainage vein-superficial scalp veins	Transarterial embolization of right STA with Squid 18	2	Excision and reconstruction	Nil/1 year/no recurrence
6	26/F	Scalp	Cosmetic reasons, bruit, headache, tinnitis	R-OA and R-STA Draining vein-R-Parieto-occipital vein Draining intracranially through emissary veins	Transarterial embolization of R -OA and STA with Squid	1	Total resection and reconstruction	Nil/1.3 years/no recurrence

Patient	Age (year) /Gender	AVM Localization	Presenting Features	Feeding Arteries	Endovascular Treatment	Previous Surgery	Surgical Treatment	Complications and Follow Up
7	35/F	Scalp, forehead	Cosmetic reasons, painful, bruit, right ocular pain	R-Anterior branch STA R-supraorbital and supratroclear branch of OA Draining Vein-Superficial scalp veins	Percuataneous embolization of venous pouch with Glue	1	Total resection and reconstruction	Nil/2 years/no recurrence

There are several evidences in the literature confirming the efficacy of combined treatment as in our case. Most extracranial AVMs require combined treatment, especially when the malformations have an infiltrating component with multiple feeding arteries. Even in these patients, the percentage of complete response (cure) is low and the recurrence rate is high. In our study, all embolization procedures were combined with surgical resection. Complete and partial response rates were relatively similar to those reported in the literature (11).

Other studies continue to conclude that combined treatment is the best approach. Diffuse AVMs are rarely easily curable but can be controlled with this treatment option despite the difficulty in achieving a successful outcome. However, delaying treatment causes the AVM to grow and infiltrate additional normal tissue making treatment less successful and more difficult.

Due to this reason, many doctors (including the author) advised that the early intervention with the treatment of AVMs is supposed to be done before the symptoms develop. This early intervention considers to be a better lesion control and AVMs are never precipitously resolved. The most obvious opportunity for treatment is from the get-go in the phase of the disease as the AVM is yet to progress to a more progressive state. This is when patients experience higher morbidity and treatment is more difficult and less productive. In summation, the management of H&N AVMs needs a multidisciplinary approach and multimodal care must be used by appropriately trained doctors. The treatment needs to be repeated and therapy must be done for disease control. The pace of development, notwithstanding, might be capricious. Improved treatment results and quality of patient satisfaction are vital and worldwide research is done on the subject to find better more solid medical choices for treatment in the hopes of finding a cure (12).

CONCLUSION

The results revealed that embolization alone is not effective to reduce the adverse effects. Incomplete removal of AVM showed the same effect as incomplete removal of a tumour. It may not improve symptoms and may worsen the recurrence, thus multi-modality approach is beneficial. A multidisciplinary approach, aided by the interventional radiologist and enable plastic surgeons to remove the high-flow AVMs effectively.

STATEMENT OF ETHICS

Written informed consent was obtained from the patients for publication of the cases and accompanying images shown in this work.

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CONFLICT OF INTEREST

The author(s) declare that they do not have any potential conflicts of interest concerning the research, authorship, and/or publication of this article with anyone.

DATA AVAILABILITY STATEMENT

The data used in this work can be requested from the corresponding author upon reasonable request.

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FIGURE LEGENDS

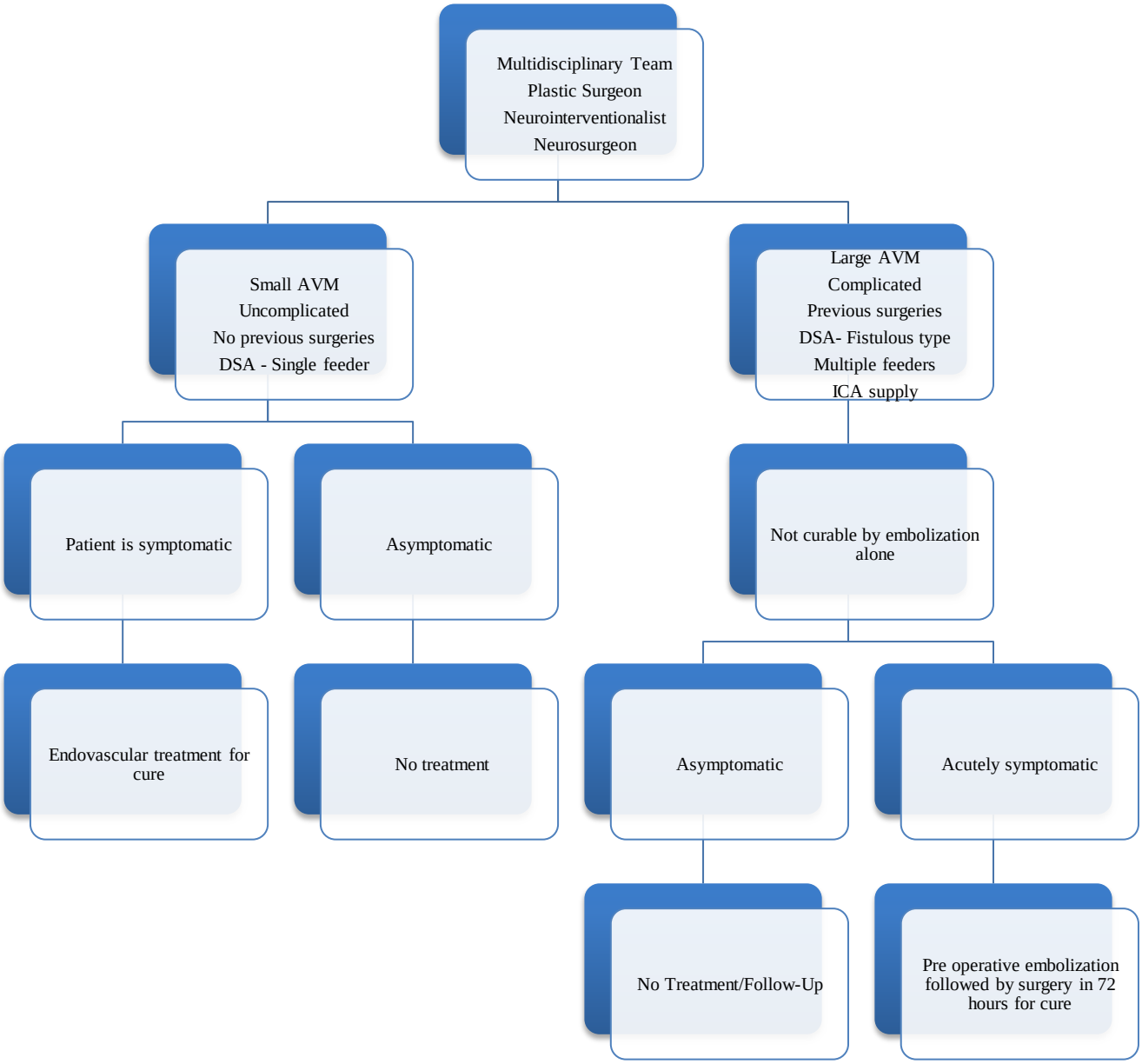

Figure 1: Schematic flow chart describing the management of H&N AVM

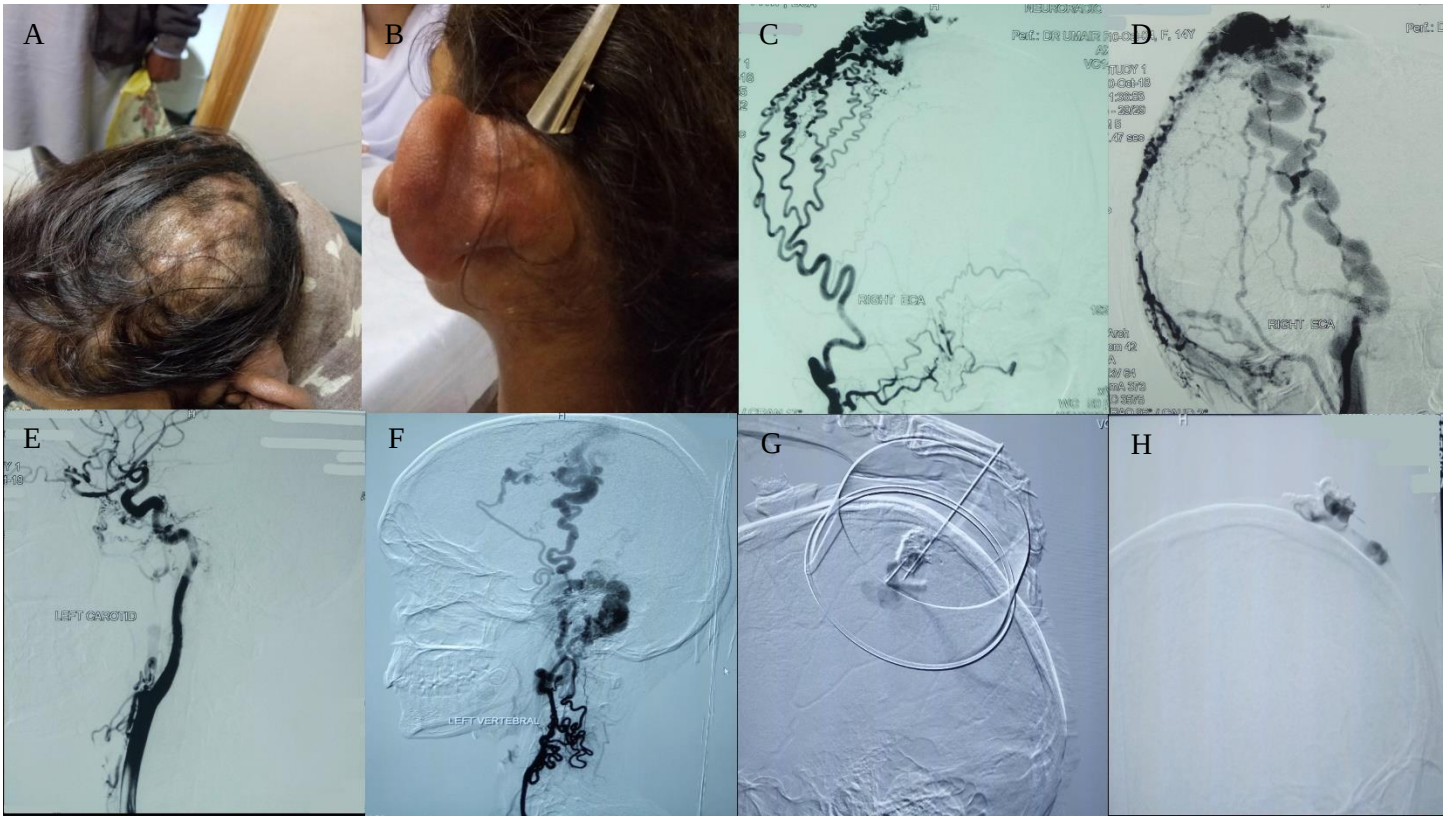

Figure 2: Case 1: (A, B) Pre-procedure photograph of a 16-year-old girl presented with double swellings – Scalp and pinna since childhood. (C, D, E, F) Right ECA angiogram, lateral projection, showing scalp AVM supplied by branches of the occipital artery. The draining vein was the dilated scalp vein.Left CCA angiogram, lateral projection, revealed ligated stump of the left external carotid artery. Left VA angiogram, lateral projection, showing auricular AVM, supplied by muscular branches of vertebral artery and contralateral external carotid artery. (G, H) Direct puncture of the nidus and glue embolization was performed with a 21 gauge butterfly needle with the occlusion of venous outflow.

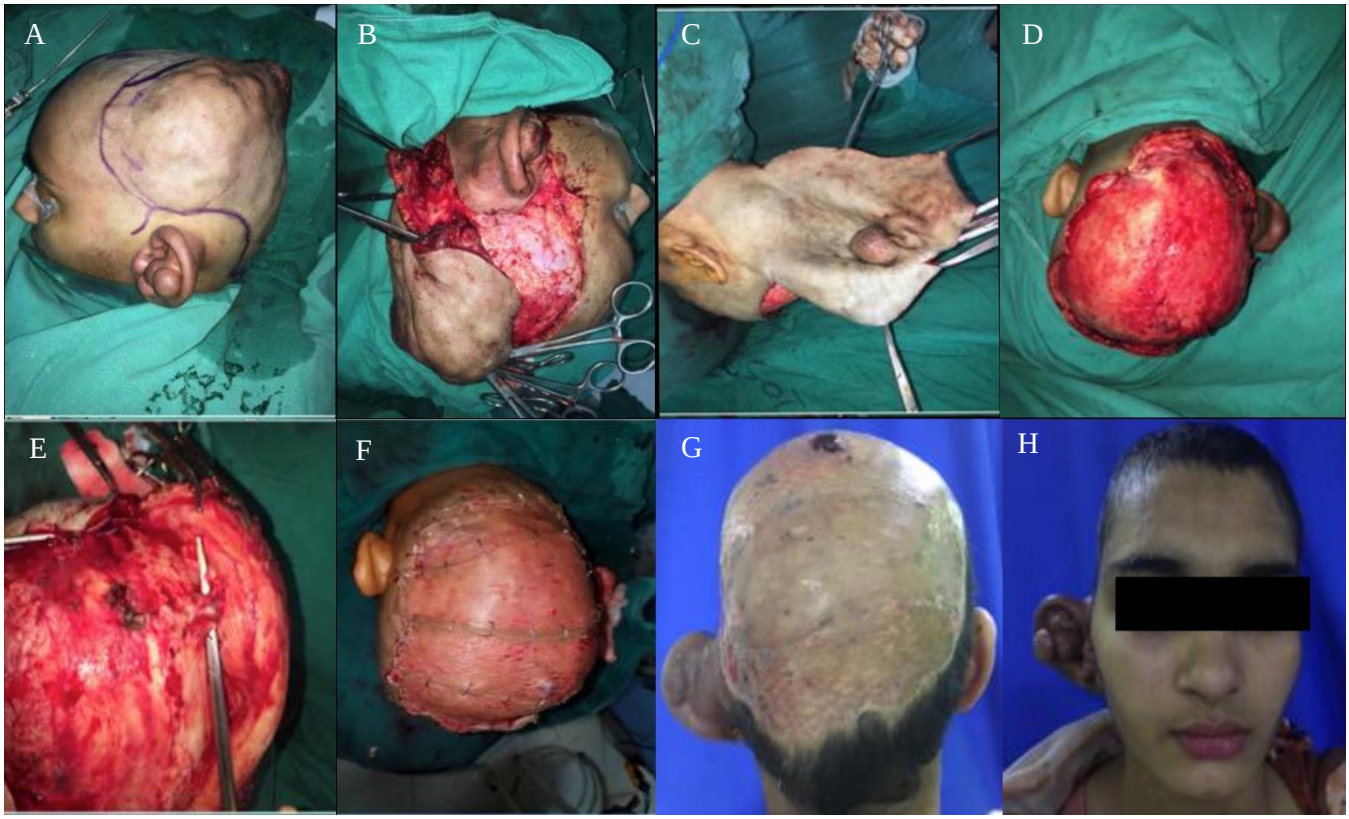

Figure 3: Case 1: (A, B, C, D, E) Embolization was followed by resection and reconstruction. An inert S-shaped incision was made that encompassed the AVM of the scalp and extended vertically into the left preauricular region. (G, H) Postoperative results.

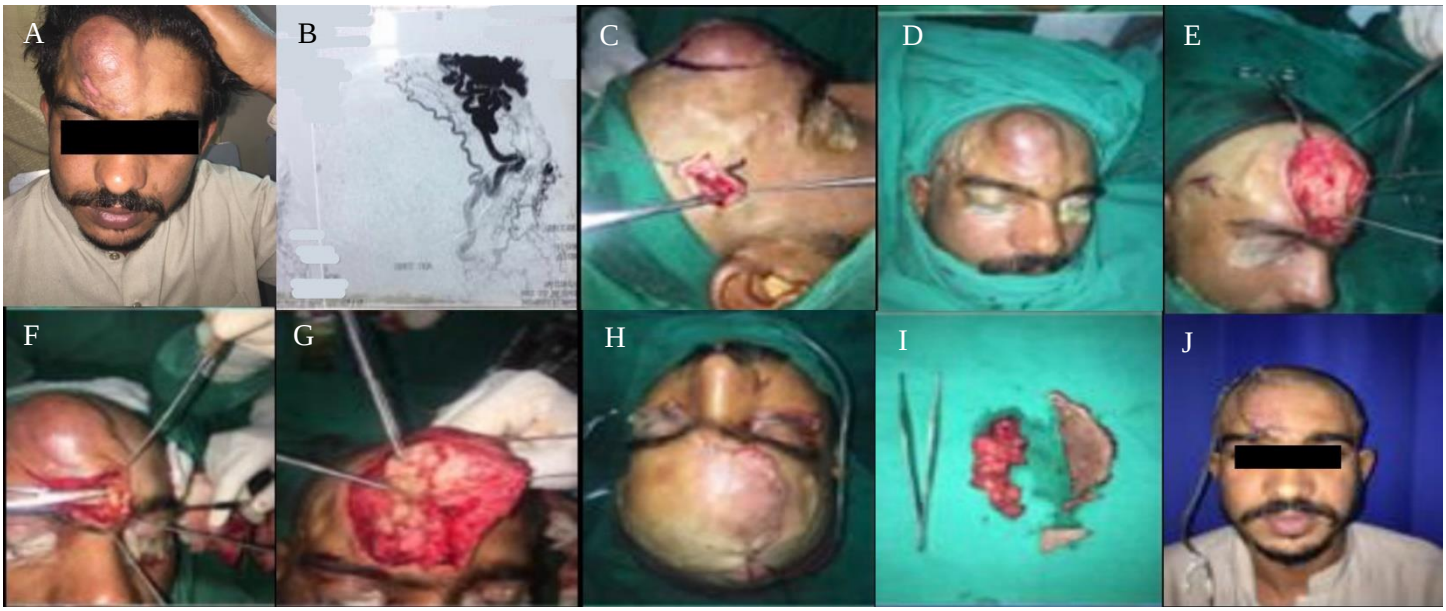

Figure 4: Case 2: (A) A 28-year-old man presented with a pulsating swelling in the right forehead since childhood. (B) Lateral angiogram of right ECA revealed hypertrophied STA with gross dilatation and tortuous course of its frontal branch along its entire length draining into nidus. Additional supply from the right ICA was also present (not shown). (C, D, E, F, G, H) Embolization was followed by resection and reconstruction occurred within 24 hours after embolization. Along the right edge of the AVM, a C-shaped incision with an upper extension of 4 cm was made in the scalp to expose and ligate one large feeder vessel. (I, J) Postoperative photograph.

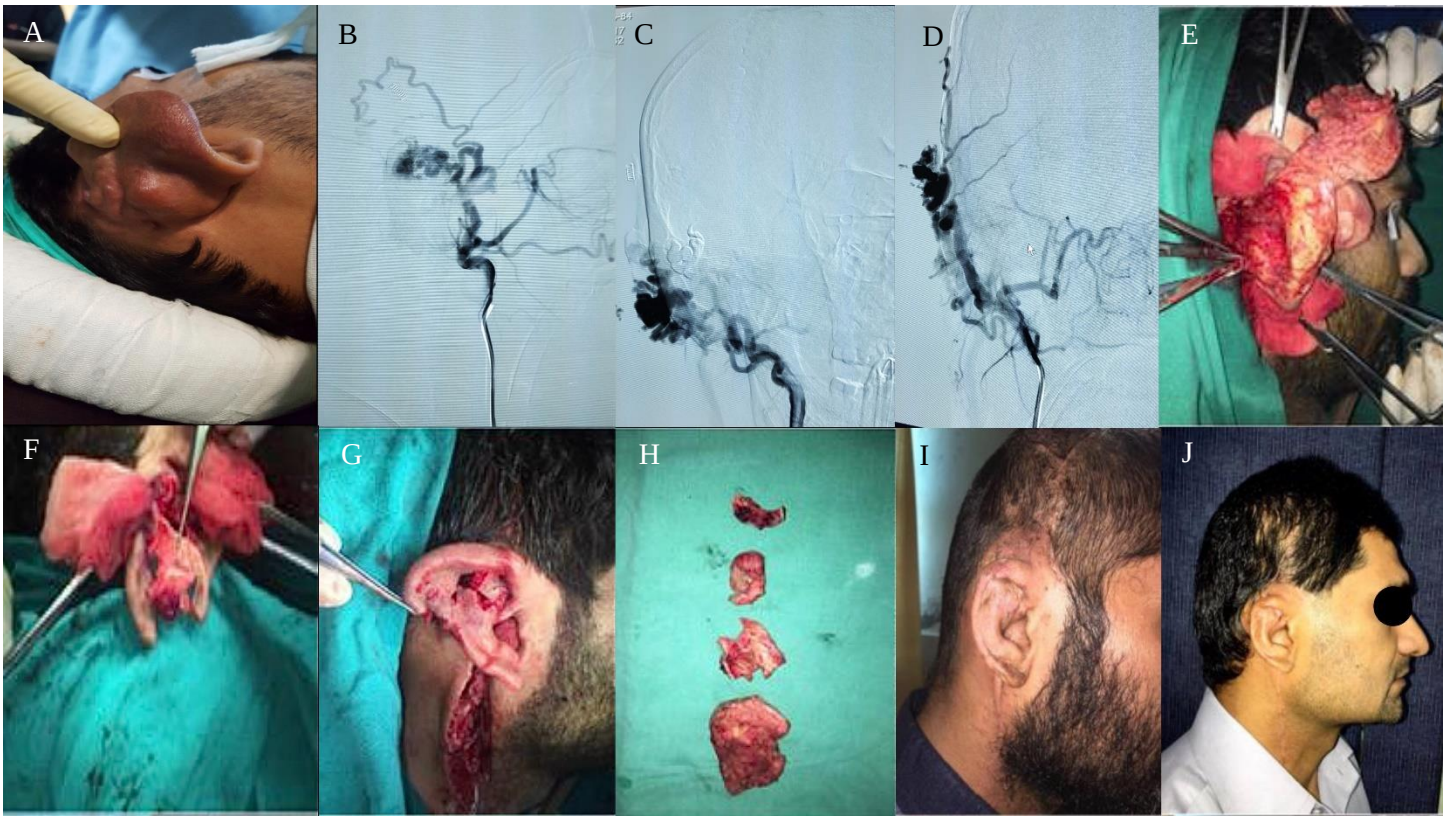

Figure 5: Case 3: (A) Lateral view of a 35-year man presented with right ear pulsating mass, redness, and swelling. (B) Lateral angiogram of the right external carotid artery (C, D) Transarterial embolization was performed with glue after selective catheterization of the posterior auricular artery. (E, F, G, H) The malformation was excised through the anterior approach, and resurfacing of the exposed auricular cartilage was performed with an ipsilateral temporoparietal fascial flap and a split-thickness skin graft from the thigh. (I, J) Postoperative and follow-up photographs.

A CASE SERIES OF SPONTANEOUS EXTRAPERITONEAL HEMORRHAGE IN COVID-19 PATIENTS IN MALAYSIA

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ABSTRACT

Background: COVID-19 infection is associated with thrombotic events causing micro thrombosis and venous thromboembolism. Anticoagulant treatment has been shown to reduce mortality in COVID-19 cases and is routinely used. Spontaneous extraperitoneal hemorrhage (SEH), which includes retroperitoneal, iliopsoas or rectus sheath hematomas, is a known complication of anticoagulant use. Trans arterial embolization (TAE) is a safe and minimally invasive management option to control bleeding in SEH. We report 7 cases of SEH in COVID-19 patients admitted to Hospital Sungai Buloh. This case series highlights the occurrence of SEH in COVID-19 patients, its clinical and radiological manifestations and management pathways.

Case presentation: All patients were on anticoagulants and presented with abdominal pain and/or swelling with sudden drop in hemoglobin. Computed tomography angiography (CTA) showed contrast extravasation indicative of active bleed. All patients proceeded with conventional transfemoral angiography with option of TAE. TAE was utilized in 6 out of 7 cases and was successful in achieving hemostasis with no procedure related complication.

Conclusion: SEH should be suspected in COVID-19 patients on anticoagulants presenting with abdominal pain or drop in hemoglobin. CTA is confirmatory and TAE offers a viable and safe treatment option.

Keywords: COVID-19, extraperitoneal hemorrhage, embolization

INTRODUCTION

The COVID-19 pandemic continues to cause unprecedented challenges to the health system. Involvement of the hematological system in COVID-19, principally thrombotic events causing micro thrombosis and venous thromboembolism has been widely written in the medical literature (1–3).

Anticoagulant treatment has been shown to reduce mortality and as such, it is routinely used in large number of COVID-19 cases (2,4). However, the liberal use of anticoagulants has its disadvantages. Spontaneous extraperitoneal hemorrhage (SEH) is a known complication of anticoagulant use (5). It includes retroperitoneal, iliopsoas or rectus sheath hematomas irrespective of cause and is increasingly being reported in COVID-19 patients (6–10).

Trans arterial embolization (TAE) allows superselective embolization of small-vessel bleeding points at various sites. It is a safe and minimally invasive management option to control bleeding of arterial origin usually seen in SEH.

Table 1. Clinical characteristics, laboratory values at time of bleeding, management and outcome of patients

Case	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Age (years)	75	55	58	64	75	62	53
Sex	Male	Male	Male	Male	Male	Female	Female
Existing disease	DM, HTN, HLP	CRF, DM, HTN	CRF, DM, HTN	HTN	No known medical illness	Chronic Hepatitis B, HLP, endometrial carcinoma	DM, HTN, bronchial asthma
COVID category	4	4	4	5 *	4	5	4
Day of COVID 19 diagnosis when SEH suspected	17	11	11	15	11	4	15
Day of enoxaparin treatment when SEH suspected	7	6	4	10	7	3	5
CTA findings	Right retroperitoneal hematoma	Left retroperitoneal hematoma	Bilateral rectus sheath hematoma	Left rectus sheath and left iliacus hematoma	Pelvic and rectus sheath hematoma	Bilateral rectus sheath hematoma	Left rectus sheath hematoma
Embolized artery	Right L3 and L4 lumbar arteries	Left L3 and L4 lumbar artery	Empiric embolization of bilateral inferior epigastric artery	Branch of left internal iliac artery	Nil (no contrast blush on angiography)	Right lateral circumflex femoral artery	Bilateral inferior epigastric artery
Hemodialysis	-	2, 4, 6	2, 4, 6	-	-	-	-
Anticoagulant	Enoxaparin (treatment dose)	Enoxaparin (prophylaxis dose)	Enoxaparin (prophylaxis dose)	Enoxaparin (treatment dose)	Enoxaparin (treatment dose)	Enoxaparin (treatment dose)	Enoxaparin (treatment dose)
Hb (g/dL)	5.1	5.5	6.2	7.9	6.8	6.0	5.6
PLT ($x10^9$/L)	364	285	282	202	342	259	283
PT (INR)	1.52	1.16	0.94	1.09	1.09	1.03	1.06
APTT (sec)	50.4	46.0	42.0	36.6	29.1	53.4	49.1
Embolic agent	Coil	Gelatin sponge	Gelatin sponge	Gelatin sponge	Nil	Coil	Coil
Signs and symptom during bleeding	Abdominal pain and swelling	Abdominal pain and swelling	Abdominal swelling	Abdominal swelling	Abdominal pain and swelling	Abdominal pain and swelling, hypovolemic shock	Abdominal pain and swelling, hypovolemic shock
Outcome at day 30 post embolization	Death	Survived	Death	Death	Survived	Death	Survived

CASE PRESENTATION

We experienced 7 patients with COVID-19 infection confirmed to have SEH in between April 2021 to September 2021, at the height of Malaysia's third wave of COVID-19 cases.

Patient's past medical histories, blood investigation before angiography, signs and symptoms during bleeding, imaging findings, bleeding vessel and management pathways were collected and summarised in Table 1.

APTT: activated partial thromboplastin time, CRF: chronic renal failure, CTA: computed tomography angiography, DIVC: disseminated intravascular coagulation, DM: diabetes mellitus, Hb: hemoglobin, HLP: hyperlipidemia, HTN: hypertension, PC: packed cell, PLT: platelets, PT(INR): prothrombin time (international normalized ratio), *: intubated prior to bleeding

Patients age ranged from 53 to 75 years (average 63 years). None of these patients had prior hematologic disease or were on regular antiplatelet or anticoagulant therapy. Two patients were on regular hemodialysis.

Four patients were in category 4 (symptomatic, pneumonia requiring supplemental oxygen) and 2 patients were in category 5 (critically ill with multi-organ involvement). All the patients received enoxaparin (2 on prophylaxis dose and 5 on treatment dose). Four patients had pulmonary embolism confirmed on CT pulmonary angiogram. Prior to these bleeding events, 6 patients required supplemental oxygen therapy with non-invasive ventilation and 1 patient required invasive ventilation.

The mean number of days from initial COVID-19 diagnosis to the development of SEH was 12 days (range 4 – 17 days). The mean number of days of the development of SEH from the commencement of enoxaparin in the 7 patients was 6 days (range 3 – 10 days). Clinical diagnosis of SEH was suspected when patients had abdominal pain and/or swelling with abrupt drop in hemoglobin. All the patients underwent urgent CTA followed by conventional angiography within 24 hours of suspected SEH. Two patients developed hypovolemic shock.

Prior to angiography, the hemoglobin ranged from 5.1-7.9g/dL (average 6.2g/dL), platelet count ranged from 202-364x109/L (average 288x109/L), prothrombin time (international normalized ratio) ranged from 0.94-1.52 (average 1.12) and activated partial thromboplastin time ranged from 29.1-53.4s (average 43.8s).

SEH was diagnosed by computed tomography angiography (CTA), which showed contrast extravasation indicative of active bleed. No vessel malformations were found. Four patients had rectus sheath hematoma, 2 patients had retroperitoneal hematoma and 1 patient had both rectus sheath and retroperitoneal hematoma.

Every patient went for conventional transfemoral angiography. Bleeding vessels were identified in 5 patients with good agreement to CTA findings (Figs 1A, B, 2A, B, C). Three patients showed bleeding points from more than one artery. A single type of embolic agent was used in each case. Hemostasis was achieved in 2 patients using gelatin sponge and 3 patients using coils. In 2 patients bleeding was not identified on conventional angiography; 1 had empiric embolization with gelatin sponge and 1 was managed conservatively based on CTA findings and clinical condition. One interventional radiologist performed all 6 embolization procedures. There were no complications. None underwent surgery.

Each of the 6 patients who had TAE required a single embolization intervention to achieve hemostasis. TAE was successful in stabilizing the hemoglobin level at 24 hours for all patients. Two patients were alive at 30 days after embolization. Despite the technical success of embolization, four patients died within 30 days after embolization. These 4 deaths were probably unrelated to TAE due to the absence of signs of hypovolemic circulatory collapse prior to their deaths.

DISCUSSION

SEH is a serious event which requires urgent investigation and management. It carries a mortality rate ranging from 20-30% (5,11–13). Its risk factors include use of anticoagulants, age over 65 years, end stage renal failure, hemodialysis, heart failure, hepatic insufficiency, coagulation disorders and higher COVID-19 categories (6–9,12,14,15). Our set of patients similarly had these risk factors. One study of COVID-19 patients showed an incidence of 1.8% of major spontaneous hemorrhage in patients on prophylactic low molecular weight heparin, as

opposed to 0.5% in general hospitalized patient (16,17). Another study showed an overall bleeding rate of 4.8% with major bleeding rate of 2.3%, most of whom were anticoagulated (3). Coughing and positive pressure ventilation, both common in COVID-19 patients, may cause raised intra-abdominal pressure leading to possible vessel rupture. The systemic cytokine storm which occurs in COVID-19 infection may also cause endothelial cell dysfunction and abnormal platelet recruitment, which increases the propensity to bleed (1,18).

SEH commonly present as hypotension, abdominal pain/swelling or drop in hemoglobin (5–8). Clinical symptoms and signs of SEH may not be apparent until a bleeding patient has suffered substantial blood loss. Therefore a high index of vigilance for SEH is necessary in COVID-19 patients on anticoagulation by close monitoring of vital signs and serial hemoglobin estimates. Signs of hypovolemia, anemia and symptoms abdominal or flank pain should raise the suspicion of hemorrhage. CTA should be promptly performed to diagnose these non-overt SEH. Active bleed on CTA is seen as contrast extravasation with increased pooling on delayed phase. CTA has up to 87% sensitivity in detecting active bleed in good agreement with angiographic findings (13,19–21).

Immediate management should include supportive measures such as fluid resuscitation, blood transfusion and cessation/reversal of anticoagulant to optimize coagulation status (22). Management options for SEH are conservative treatment, TAE or surgery. Medical management is possible if patient is hemodynamically stable, relatively small hematomas with no evidence of active bleed on CT and patients not requiring repeated transfusion (23). Lucatelli et al. experience with SEH in 21 patients with COVID-19 showed most patients who were on conservative management had to be referred for angiography after median of 2 days due to persistent drop in hemoglobin (24).

In active bleeding, conservative management can be unsuccessful needing urgent timely intervention (13,19,22). TAE is a safe and effective method in treating SEH with a low rate of complications (12,13,15,20). Surgery is reserved for failure of conservative management, in patients with persistent bleeding despite radiologic TAE, and in the development of abdominal compartment syndrome (22). TAE has had significant success in stopping further SEH bleeding including in this case series, although in few cases needing repeat session (7,9,23,24). A study of 21 COVID-19 patients with spontaneous bleed treated with TAE showed overall survival rate of 70% at 30 days (23). Our survival rate of 33% was lower than in the literature, likely to be related to the severity of their COVID-19 categories, co-morbidities and our small sample size. We observed that none of the patients had further significant drop in hemoglobin post embolization and prior to death.

The most common arteries involved in SEH are the inferior epigastric artery and deep circumflex artery in abdominal wall bleeding, and the lumbar arteries in retroperitoneal bleed (13). More specific to COVID-19, the typical bleeding pattern seen is of multiple foci of bleeding involving distal branches, as seen in 3 of our patients (16) (Fig. 2B). It is prudent to catheterize all the arteries of the same anatomic territory of the hematoma to locate other bleeding arteries or anastomosis (Figs. 2B, C). Some patients may show contrast extravasation in CTA but negative findings in conventional angiography (11). One reason may be due to the higher sensitivity of CTA in identifying contrast extravasation compared to conventional angiography. CTA is capable of detecting bleeding at rate of 0.3-0.5mLs/min as opposed to conventional angiography at rate 0.5-1.0mls/min (25,26). Other reasons include intermittent bleed, spasm, hypotension or soft tissue tamponade. Therefore, empirical embolization of possibly involved arteries may control occult bleeding (14,21,24). Re-bleeding is more often due to delay in correction of abnormal coagulation profile or involvement of different artery/territory (11,13,21).

Evidence for best embolic material for TAE in SEH is lacking. Taking into consideration the bleeding pattern usually seen in COVID-19, the use of small sized polyvinyl alcohol particles were utilized in superselective embolization of the entire arterial segment related to the bleeding (27). This allows distribution of embolic material to the most distal branches. Coil is preferred in embolizing larger diameter single vessel or feeding vessel (28). Its disadvantage is incomplete occlusion in presence of collaterals, commonly seen in rectus sheath hematomas. Gelatin sponge is a temporary embolic

agent with relatively distal target embolization, used in smaller targeted vessels or empirical embolization. However, the embolized arteries recanalize between 3 weeks to 4 months, which may cause re-bleeding (29). Combination of gelatin sponge and coil embolization may be used if either agent does not stop the bleeding vessel on its own (12). The recurrence rate of SEH was found to be similar between resorbable and non-resorbable embolic material (13). Our case series demonstrated technical success in the use of either coil or gelatin sponge to stop the bleeding. Liquid embolic agents such as N-butyl cyanoacrylate glue has also been used successfully for embolization of SEH in COVID-19 patient (24). It is fast acting, permanent and its effect does not depend on coagulation process hence useful in coagulopathic patients. However, it requires extensive operator experience and superselective cannulation of bleeding branches to prevent non-target embolization (30).

Limited literature is available as to when to reinitiate anticoagulants after SEH, especially in COVID-19 patients with concurrent deep venous thrombosis or pulmonary embolism. One study of 15 non COVID-19 patients with retroperitoneal hemorrhage showed out of 12 patients who survived, 4 patients restarted anticoagulation after a withdrawal period of 4-25 days without further complications (5).

CONCLUSION

SEH is a potentially lethal complication of COVID-19 infection, especially in the elderly on anticoagulation. A high index of suspicion is needed in patients with abdominal pain and decline in hemoglobin level. Failure of conservative management, hypovolemic shock or presence of active bleed on CTA warrants treatment with TAE.

STATEMENT OF ETHICS

This study has been granted an exemption from requiring ethics approval from Medical Research and Ethics Committee, Ministry of Health Malaysia (NMRR ID-21-02091-K8G (IIR).

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

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FIGURE LEGENDS

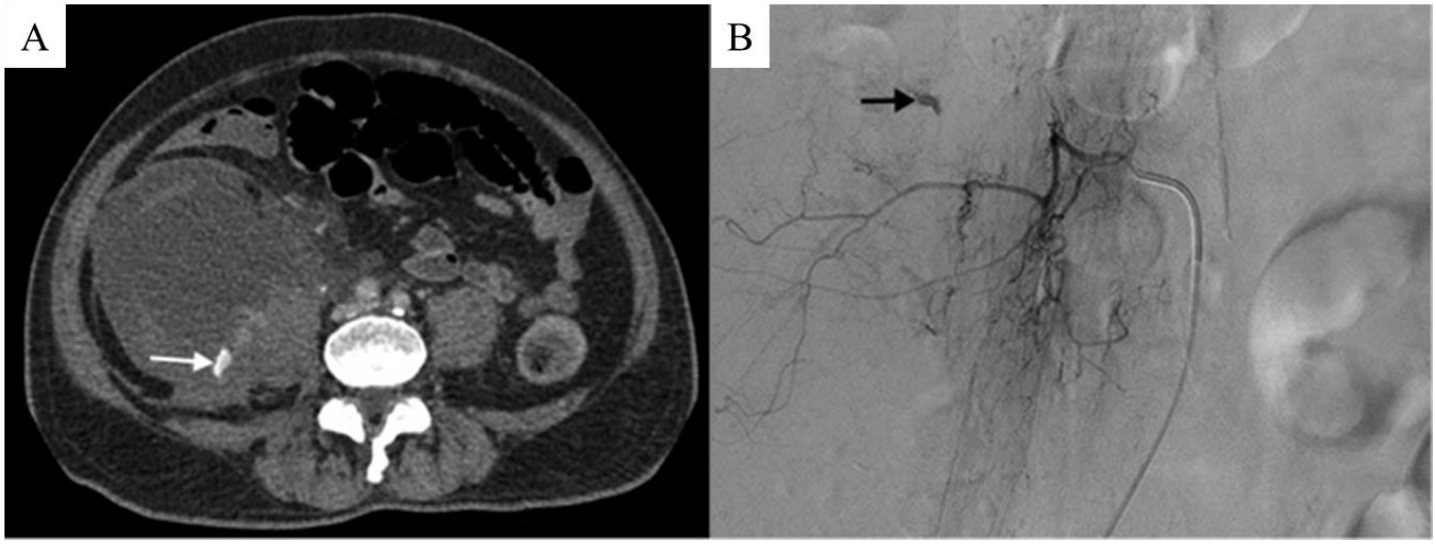

Figure 1: Images from a 75 year-old with retroperitoneal hematoma (patient 1). (A) Computed tomography angiography shows large right retroperitoneal hematoma with contrast extravasation (white arrow). (B) Digital subtraction angiographic image shows extravasation from branch of right L3 lumbar artery (black arrow).

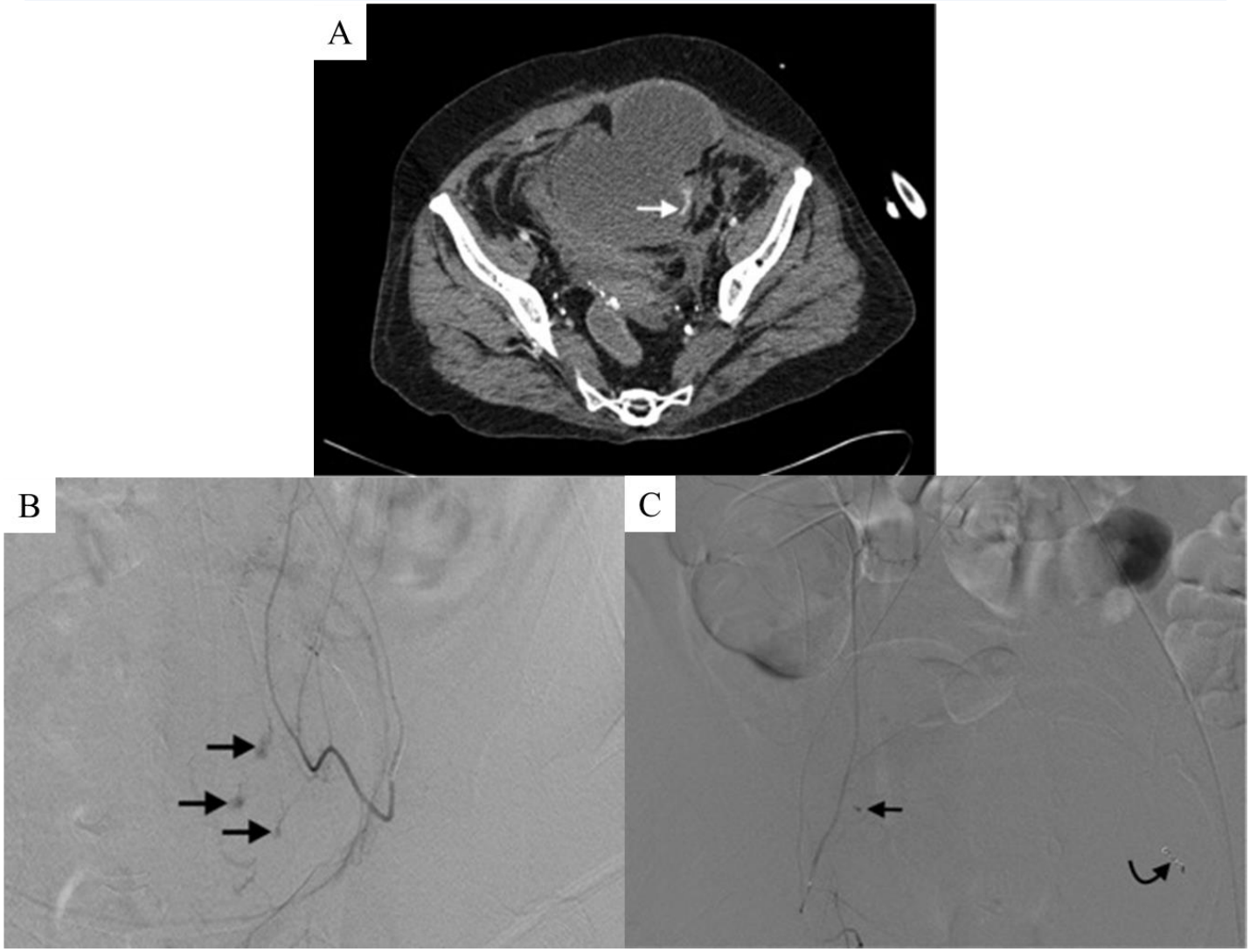

Figure 2: Images from a 53 year-old with left rectus sheath hematoma (patient 7). (A) Large rectus sheath hematoma with contrast extravasation (white arrow). (B) Digital subtraction angiographic image showing multiple bleeding points from left inferior epigastric artery (black arrow). (C) Digital subtraction angiographic image showing bleeding point from right inferior epigastric artery (black arrow) and coiled left inferior epigastric artery (curved black arrow).

RENAL CELL CARCINOMA WITH FACIAL SWELLING AND NASAL OBSTRUCTION AS PRIMARY PRESENTATION

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ABSTRACT

Background: Renal cell carcinoma (RCC) is a slow growing tumor. About 25–30% of patients are found to have metastases at diagnosis commonly to lung, liver and bones. The incidence of renal cell carcinoma metastasizing to the head and neck has been reported to range from 15-30%. Intranasal mass, or occasionally orbital mass maybe the presenting symptom of metastatic renal cell carcinoma to the nose and sinuses.

Case presentation: We report a case of left RCC with large metastases to the frontonasal region producing head and neck symptoms before the primary lesion could be detected. Clinical presentations of metastatic RCC to the nasal and paranasal regions varies from recurrent epistaxis, nasal obstruction, facial pain, induration or even an orbital mass. In our case, although the patient had typical presentation of metastatic nasal tumour, the diagnosis of metastatic disease was not made.

Conclusion: Patient presented with nasal and paranasal region tumour with no other systemic symptoms, presence of metastatic disease particularly from renal cell carcinoma should be included in diagnosis, as it is a slow growing tumour and the fact that nasal and paranasal areas are the most commonly affected site of metastatic RCC in the head and neck region.

Keywords: Renal neoplasm; Neoplasm metastasis; Paranasal sinuses; Clear cell renal cell carcinoma; Biopsy

INTRODUCTION

Renal cell carcinoma (RCC) is a slow growing tumor. At the time of diagnosis, about 25–30% of patients had metastases (1), most typically to the lung, liver, and bones. Renal cell carcinoma that has spread to the head and neck has been found to occur in 15-30% of cases (2). The presenting symptom of metastatic renal cell carcinoma to the nose and sinuses may be an intranasal or ocular mass.

We present a case of left RCC with extensive frontonasal metastases that caused head and neck symptoms before the main lesion was discovered. The results of ultrasonography, CT, MRI, and angiography imaging are provided.

CASE PRESENTATION

A 70 year-old man presented nine months earlier at another hospital with progressive left-sided nasal obstruction associated with nasal discharge and irregular epistaxis. Contrast- enhanced computed tomography (CT) scan then showed a large expansile

mass occupying the left maxilla with erosion into left orbit, hard palate and extension into the infratemporal fossa. He underwent a medial maxillectomy which revealed a fleshy and vascular intranasal mass. Instead of tumour excision, a biopsy was performed and an initial diagnosis of sinonasal paraganglioma was made. Because MRI was not accessible at the hospital, the patient was referred to our centre for further imaging and care.

MRI of the paranasal sinuses at our centre showed a lobulated mass in the left maxillary sinus, measuring 6.1cm (AP) x 4.5cm (W) x 5.6cm (Ht). The mass returned mixed signal intensity on T1W, T2W and FLAIR with inhomogeneous enhancement in post gadolinium images. Within the structure, there were necrotic zones. The mass extends medially, obliterating the left nasal cavity and causes the nasal septum to deviate to the right. There was bowing of the anterior wall of the maxillary sinus with posterior extension to the anterior wall of the sphenoid sinus (**Figure 1**).

Due to the highly vascular tumour, a pre-operative embolization of the left maxillary tumor was performed revealing that the main feeder artery originated from the left maxillary artery, with feeders originating from the left ophthalmic and right maxillary arteries (**Figure 2**). No arterial supply was demonstrated from both internal carotid arteries (ICA). Endoscopic excision of the left maxillary tumor and ligation of the left external carotid artery was performed. Intraoperatively, the tumor was adherent to the nasal septum and obliterating the entire nasal cavity with erosion of the left orbital floor, lateral nasal floor, lateral wall of the left maxilla and hard palate.

A histopathological examination of the surgical specimen was identified as clear cell carcinoma, most likely arising from differentiated renal cell carcinoma. With the former, which was sinonasal paraganglioma, there were conflicting tissue diagnoses. The 'bane' of this theatrical diagnostic dilemma was eventually determined to be poor initial sample combined with a low suspicion of the tumour being metastatic in nature.

Patient was well post operatively and was planned for radiotherapy at a later date but he defaulted follow-up and was lost to further imaging and treatment.

Patient presented seven months later with persistent left sided nasal obstruction and left facial swelling, as well as a two-week history of right nasal obstruction and epistaxis, at another hospital near to his residence. Repeated contrast enhanced CT scan of the neck showed a heterogeneously enhancing and expansile lobulated mass with necrotic centre measuring 6.0cm (AP) x 6.7cm (W) x 5.8cm (Ht), occupying the entire left maxillary sinus and partial obliteration of the right nasal cavity. There was lateral extension to the left pterygoid fossa infiltrating into the pterygoid muscle, superior extension into the left ethmoidal sinus with bowing of the left lamina papyracea, as well as bowing of the anterior and lateral wall of the left maxillary sinus. Inferiorly it extends to the roof of the oral cavity with posterior extension to the anterior wall of the sphenoid sinus (**Figure 3**).

An ultrasound abdomen later revealed a large heterogeneous and hypervascular solid mass coming from the lower pole of the left kidney, with cystic and hyperechoic components but no calcifications. This was followed by 4-phase CT scan of kidneys, demonstrating a large enhancing exophytic mass with central necrosis in the lower pole of the left kidney, measuring 10.6 x 10.1 x 8.6cm (AP x H x W) in size. The mass extends into perirenal fat but not beyond the Gerota fascia. There were numerous parasitized arteries seen surrounding and supplying this mass. No significant abdominal lymphadenopathy were present and renal vessels were intact. The right kidney was small but no focal lesion within. There were several metastatic nodules seen in the right lung. Hence, this case is a T3aN0M1 renal cell carcinoma or a stage 4 renal cell carcinoma. Patient was referred to clinical oncology department for radiotherapy.

Despite everything that had been stated and done, the patient was unfortunately lost in follow-up and therapy once more.

DISCUSSION

The clinical course and presentation of the renal cell carcinoma (RCC) are variable as it is a slow growing tumor and often go unnoticed until metastasis have occurred (2). The common sites of metastases are lungs, liver and bones (3). In the head and neck region, the nose and the paranasal sinuses is the commonest site for metastasis of RCC (3). However, primary tumour of the nasal and paranasal regions is still the commonest compared to metastatic disease.

Metastatic tumor accounts about 30% of the tumor at this region, based on the report done by Miyahara (4). Bernstein and colleagues did a study on 82 patients with metastatic tumors in the nasal or paranasal sinuses, and found the origin of metastatic tumors was renal cancer in 40 patients (49%), bronchial or lung cancer in 10 patients, breast cancer in 8 patients, testicular cancer in 6 patients, and digestive tract cancer in 5 patients (5).

Clinical presentations of metastatic RCC to the nasal and paranasal regions varies from recurrent epistaxis, nasal obstruction, facial pain, induration or even an orbital mass (6). In our case, although the patient had typical presentation of metastatic nasal tumour, the diagnosis of metastatic disease was not made due to the initial histopathological report which was reported as paraganglioma. Furthermore, patient had no abdominal symptoms to arouse the clinical suspicion of metastatic nasal tumour. From the study done by Ricard S et al. (6), 5 out of 6 patients had presented with unilateral nasal obstruction, which was similarly presented by our patient. They found only 2 patients with epistaxis as the presenting complaint, in contrast with Bernstein JM et al (5) who found epistaxis associated with blood- stained nasal discharge as the most common presenting symptom (70%) of this sinonasal lesion.

Metastatic tumour of RCC at this region is known to be hypervascular (2). As in our case, a hypervascular tumour was well demonstrated on conventional angiogram in which due to its hypervascularity, histopathological sampling was challenging. In another case, as reported by certain writers, RCC can metastasis in the form of an arterio-venous malformation, as Caunter G et al. discovered (10). As a result, a hypervascular tumour is unlikely to be metastatic in origin. As what is usually encountered in RCC, there are mutation in the von Hippel-Lindau (VHL) gene which may lead to abnormal angiogenesis pathway (11) leading to the hypervascular nature of the lesion. According to Yoshimura et al. (7) symptoms of metastatic tumors in the nasal or paranasal sinuses preceded those of primary tumors in 11 out of 18 patients, so when a hemorrhagic tumor is seen in the nasal or paranasal sinuses, renal cancer should be suspected.

The maxillary sinus is the most common site (50%) of paranasal sinuses metastasis from RCC followed by the ethmoidal sinuses, frontal sinuses, nasal cavity and sphenoid sinuses (4). There are several postulations on the route of spread of this metastatic RCC to the head and neck region. Hematogenous spread via systemic circulation was postulated to be through the lungs, leaving microscopic seedings of the lung parenchyma, which would not be visible on the chest radiograph (5). Some postulated these tumours have the ability to bypass the pulmonary capillary filtration mechanism and metastasize directly to the head and neck region via Batson's venous plexus or lymphatic spread via thoracic duct to the head and neck whereby they can anastomose with the great veins of the head or by means of retrograde flow and spread to the nose and sinuses, cutaneous sites and thyroid gland (5,6).

Conflicts arises as there were two histological variances deriving from the same tissue origins as what was observed in our case. However, this is not uncommon due to morphologic similarities between clear cell renal carcinoma and paragangliomas as explained by Lapinski JE et al. (9). For the untrained eye, the morphology and immunohistochemistry of clear cell renal cell carcinoma and paranganglioma are almost identical. However, there are numerous immunohistochemistry markers that might help narrow down the diagnosis; provided there are adequate specimens to be sampled upon. As in our case, when formerly presented with a limited specimen, it ultimately comes down to one's diligence in choosing the best immunohistochemical markers. Extra clinical data such as 'renal mass' as what we had uncovered during ultrasound abdomen when the patient was latterly presented, might surely affect how the tissue diagnosis was made. However, as this case was presented with nasal mass rather than an abdominal mass, we decided to write this case report to emphasise that metastatic renal malignancy should not be overlooked among the many possible tissue diagnosis.

The role of surgery is limited to provide tissue for diagnosis and also surgical debulking of residual disease which may prove very effective after radiotherapy (6). Local symptomatic control with radiotherapy is excellent according to Ricard S et. al (6), whereby they support that the patients with metastatic renal cell carcinoma to the nose and sinuses should be treated with curative intent unless the patient is in the terminal stage of the disease.

CONCLUSION

In conclusion, at this age group of patient who presented to us with nasal and paranasal region tumour with no other systemic symptoms, we should be aware of metastatic disease particularly from renal cell carcinoma as it is a slow growing tumour and the fact that nasal and paranasal areas are the most commonly affected site of metastatic RCC in the head and neck region. For this vascular tumour, pre-embolization of the tumor is excellent to reduce its vascularity as part of pre-surgical management.

STATEMENT OF ETHICS

Informed consents was taken from the patients and each data obtained are treated with extreme confidentiality.

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CONFLICT OF INTEREST

The authors report no conflicts of interest in this work.

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DATA AVAILABILITY STATEMENT

The authors are contactable via emails for further enquiries.

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FIGURE LEGENDS

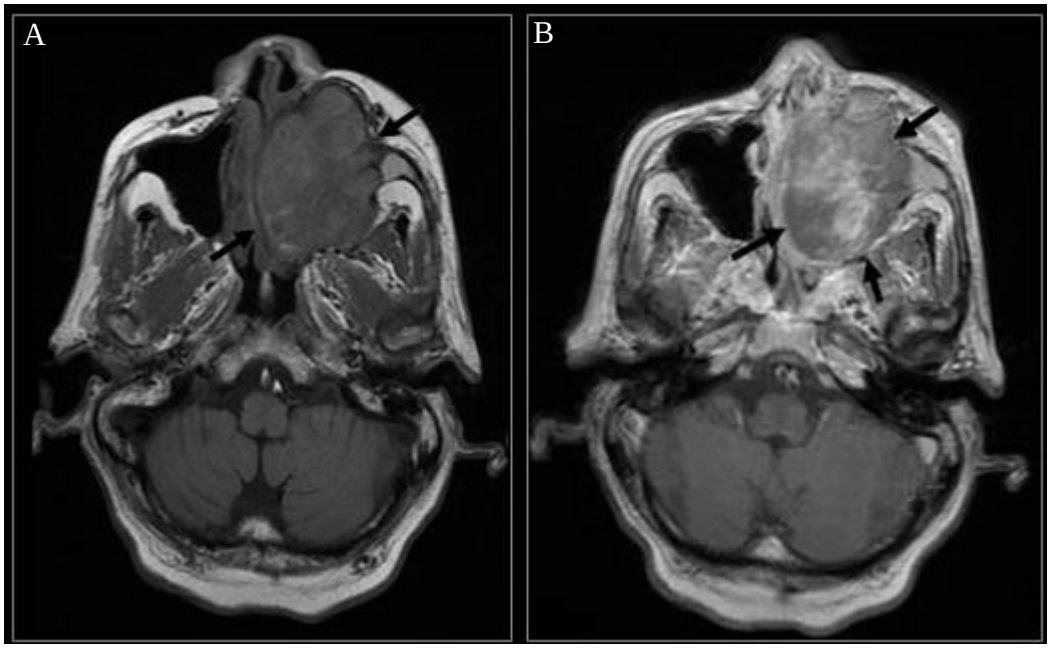

Figure 1: Axial spin-echo T1-weighted MR (A) pre-gadolinium and (B) post-gadolinium images of the nasal cavity and maxillary antrum (B) showing tumor mass in the left maxillary antrum and nasal cavity (black arrows) returns mixed signal intensity and inhomogeneous enhancement. This mass extends medially into the left nasal cavity causing obstruction of the left nasal cavity and deviation of nasal septum to the right. Anteriorly it causes bowing of the anterior wall of the maxillary sinus.

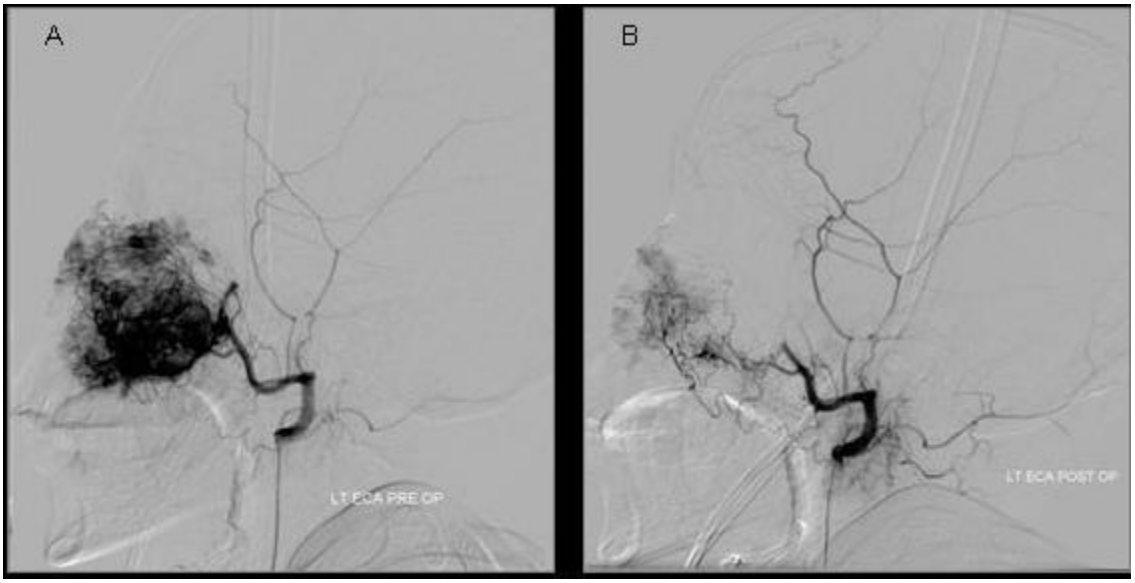

Figure 2: Digitally-subtracted left external carotid angiogram in lateral view during (A) pre-embolization of the left maxillary tumour which showed a hypervascular mass with the main feeder artery arising from the left maxillary artery. (B) Post-embolization showed marked reduction in the vascularity of the tumour.

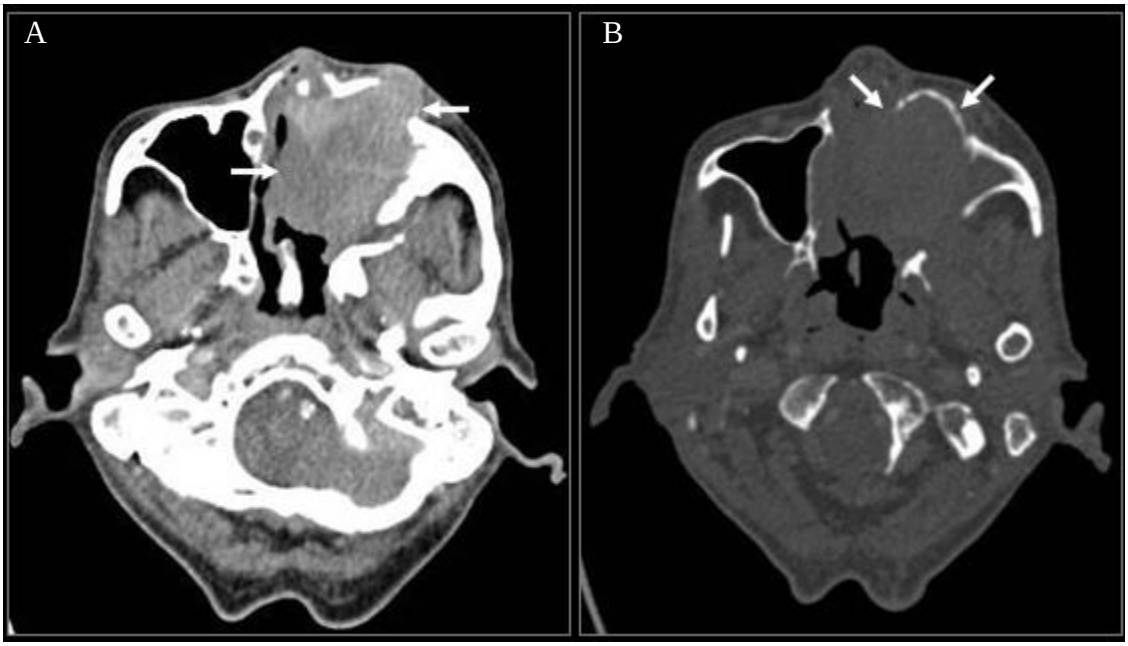

Figure 3: Axial images from contrast-enhanced CT of head and neck in (A) soft tissue window and (B) bone window demonstrating the left maxillary tumor (black arrows) with extensive local infiltration and destruction.

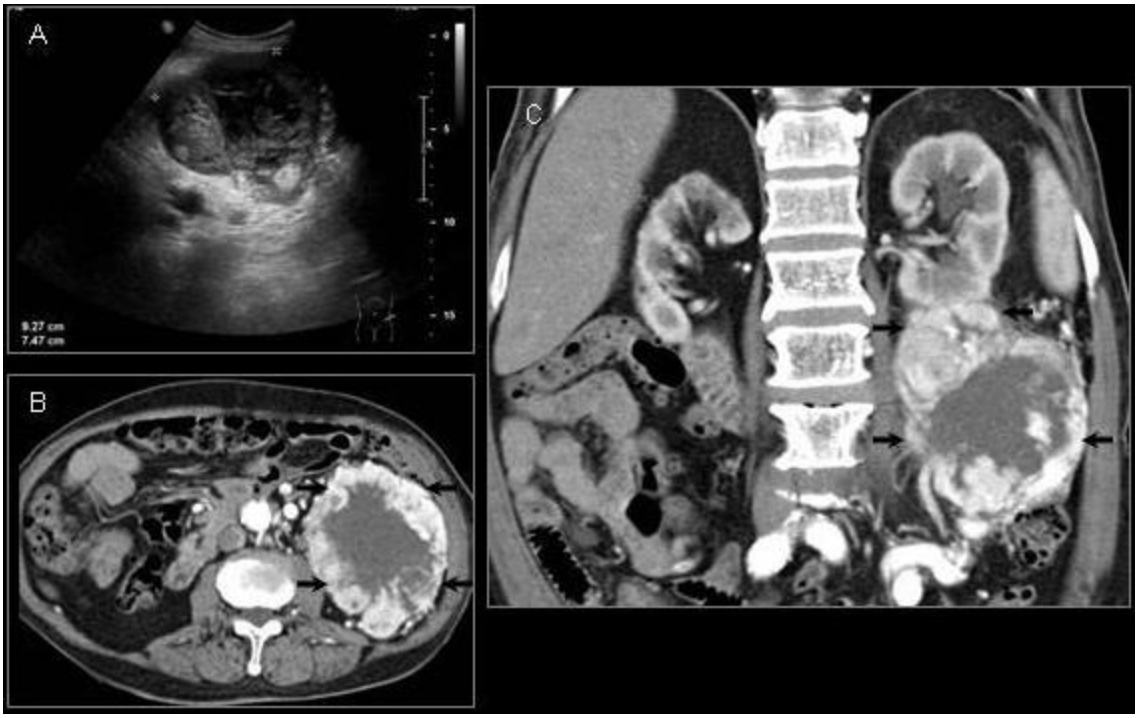

Figure 4: Left para-sagittal ultrasound image (A) showed large heterogenous tumour in the lower pole of left kidney. Contrast-enhanced CT scan of the abdomen in (B) axial plane and (C) coronal reformatted image showing a hypervascular left renal mass (black arrows) with necrotic centre and multiple parasitized arteries supplying the mass.

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