ROLE OF INTERVENTIONAL RADIOLOGY IN THE MANAGEMENT OF PERIPHERAL VASCULAR MALFORMATIONS: A TERTIARY CARE CENTRE EXPERIENCE

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I have no disclosures. No conflict of interest.
INTRODUCTION

- Peripheral vascular malformations (PVMs) represents a wide spectrum of vascular abnormalities occurring due to **anomalous connections** between arteries, veins, capillaries and lymphatic channels at microscopic level in different combinations.
- These lesions are characterized as **low, intermediate and high flow lesions** depending upon the flow pattern and velocity.
- Symptoms such as pain, swelling, functional disabilities and cosmetic deformity can lead to **significant morbidity**.
Sclerotherapy either alone or in combination with embolization has been used as an independent method as well as an adjunct to surgery for treatment of PVMs.

Selection of sclerotherapeutic and embolizing agents vary depending on location and characteristic of vascular malformations and radiologist preference.

PVMs are rare in occurrence, challenging to treat and there is significant variation in the choice of sclerotherapeutic and embolizing agents among different operators.
OBJECTIVE

- The aim of this study is to assess the **safety and efficacy** of sclerotherapy and embolization, with or without surgery for treatment of peripheral vascular malformations.
MATERIALS AND METHODS

Study Design
- Retrospective review

Duration of study

Setting
- Department of Interventional Radiology, Liaquat National Hospital.
MATERIALS AND METHODS (Cont):

- Diagnosis of PVMs was made on the basis of physical examination and imaging.

- Imaging modalities include:
  - **Ultrasound (U/S)** was done on Toshiba Xario 100 using 5 MHz and 7.5 MHz high frequency probe
    - Gray scale with Color Doppler U/S.
  - **Magnetic resonance imaging (MRI)** was done on Toshiba Excelart Vantage (ATLAS) 1.5 Tesla
    - MRI protocol included T1, T2 weighted images with and without fat saturation and post contrast T1 images with fat saturation in axial, coronal and sagittal planes.
  - **Angiography** was done on Toshiba infinix 8000V and was performed in high and intermediate flow PVMs.
Lesions were characterized depending on their flow pattern and velocities as:

<table>
<thead>
<tr>
<th>Flow Type</th>
<th>Characterization</th>
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<tbody>
<tr>
<td><strong>High flow</strong></td>
<td>• Predominant arterial flow pattern</td>
</tr>
<tr>
<td><strong>Intermediate flow</strong></td>
<td>• Predominant venous flow but also having arterial flow</td>
</tr>
<tr>
<td><strong>Low flow</strong></td>
<td>• Only monophasic venous flow</td>
</tr>
</tbody>
</table>
Sclerotherapy and embolization were performed under real time U/S and fluoroscopic guidance using:

- **STS** (3% sodium tetradecyl sulphate, Setrol, Samrath life sciences, Mumbai).
- **Glue** (Glubran 2, GEM S.r.l, Viareggio Italy) with lipoidol (lipoidol Ultra-fluid 480 mg/ml, Guerbet, Istanbul).
- **Bleomycin** (Bleomycin 15mg, Fresenius Kabi, USA, LLC.).
- **Covered stent** (Wall graft, Boston scientific).
- **Gelfoam** (Equispon, Equimedical BV, The Netherlands).
- **Coils** (2D Helical-35, Boston Scientific, Cork, Ireland).
- **PVA particles** (Contour, Boston scientific, Natick USA).
MATERIALS AND METHODS (Cont):

- **STS foam** was created with 1 ml STS mixed with 3 ml of air and 1 ml contrast.
- **Glue** was injected in combination with lipoidol in 1:1 ratio usually. Amount of glue and lipoidol varied according to the lesion size and response.
- Sclerotherapeutic and embolizing agents were selected according to the location and characteristic of PVMs.
- **STS** was used for low and intermediate flow lesions and high flow lesions were embolized using covered stent, coils, PVA, gel foam, glue and bleomycin in various combinations.
MATERIALS AND METHODS(Cont):

PROCEDURE OF INJECTION:

- After localizing the lesion under U/S, cannulation with needle (20G, 22G, 25G BD spinal needle, Becton Dickinson S.A., Spain) was done and contrast (Iomeprol, Braccos.p.a., Milano, Italy) was injected to delineate the lesion on fluoroscopy.
- Percutaneous injection of sclerotherapeutic and embolizing agents were done using U/S and fluoroscopic guidance.
- Out flow veins were occluded or compressed using tourniquet during injection wherever possible.
- Injection was stopped when thrombosis of vascular channels was seen on U/S and loss of flow is identified on angiography.
MATERIALS AND METHODS (Cont):

- **Technical success** was defined as optimal injection of sclerosant or exclusion of lesion by embolization as demonstrated by angiography or U/S.

- **Clinical success** was assessed by reduction in pain, improvement in swelling and function on followup.

- **Follow up** of all patients included clinical evaluation, physical examination, gray scale and color doppler U/S.

- MRI was not routinely done in follow up of all patients.
Response to treatment was characterized as:

- **Marked response:** Complete resolution of symptoms
- **Partial response:** Reduction in symptoms but still present after procedure
- **No response:** No improvement in symptoms.
RESULTS

- 32 sessions were performed in 14 patients
- Male to female ratio: 1:1 (7 male, 7 female)
- The mean age of patients was 22.7 years (range 10-37 years).
- The average follow-up duration was 1.75 years (0.08-4 years).
NO. OF PATIENTS ACCORDING TO SYMPTOMS

- Pain: 9 (64.2%)
- Swelling: 5 (35.7%)
- Ptosis: 1 (7.1%)
- Dyspnea affecting sleep: 1 (7.1%)
- Life threatening oral hemorrhage: 1 (7.1%)

No. of patients according to symptoms
DISTRIBUTION OF VASCULAR MALFORMATION ACCORDING TO FLOW CHARACTERISTICS AND REGION OF INVOLVEMENT

<table>
<thead>
<tr>
<th>Region involved</th>
<th>PVM flow characteristics</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High flow</td>
<td>Intermediate flow</td>
</tr>
<tr>
<td>Upper limb</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Lower limb</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Head and neck</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
SCLEROTHERAPEUTIC AND EMBOLIZING AGENTS

- STS
- Glue with Lipoidol
- Bleomycin
- Coils with PVA particles

Legend:
- Sclerotherapeutic/ Embolizing agents
- with stent
- with STS
- with gelfoam
NO. OF SESSIONS IN EACH PATIENT

- PATIENT 1: 2
- PATIENT 2: 1
- PATIENT 3: 2
- PATIENT 4: 1
- PATIENT 5: 3
- PATIENT 6: 1
- PATIENT 7: 7
- PATIENT 8: 2
- PATIENT 9: 2
- PATIENT 10: 3
- PATIENT 11: 1
- PATIENT 12: 2
- PATIENT 13: 2
- PATIENT 14: 1
CLINICAL RESPONSE OF PATIENTS AFTER PROCEDURE

- Marked Response: 10 (71.4%)
- Partial response: 4 (28.5%)
- No response: 0 (0%)
NO OF PATIENTS WITH POST PROCEDURE COMPLICATIONS

<table>
<thead>
<tr>
<th>None</th>
<th>13 (92.8%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gangrene</td>
<td>1 (7.1%)</td>
</tr>
</tbody>
</table>
NO OF PATIENTS WITH RECURRENCE

- No Recurrence: 12 (85.7%)
- Recurrence: 2 (14.2%)
DISCUSSION

- PVMs are rare and challenging lesions to treat with estimated prevalence of **1.5 %** in population [1].

- It is of immense importance that interventional radiologist is aware of the available treatment techniques and is skilled in their implementation keeping in view the associated benefits, complications and outcomes.
Mendonca et al. [2] states that “In distal lesions sclerotherapy should not be done because of the risk of necrosis and compartment syndrome”.

In our study, we have performed sclerotherapy in three patients having vascular malformations in foot among whom one patient develop gangrene resulting in amputation of 2nd to 5th toe.

In our opinion, this complication developed due to tight compression bandage applied after procedure.

More over this patient also had previous surgery of foot that led to compromised vascular supply and may have contributed to the development of gangrene.
DISCUSSION (Cont..)

- Therefore, care should be taken in applying compression bandage after sclerotherapy so that venous outflow obstruction resulting in swelling of limb or vascular compromise should not occur.

- Close patient observation is necessary following sclerotherapy of lesions involving limbs distally.

- Weiss et al. [3] reported
  
  “30 mmHg support stockings worn for 3 weeks after sclerotherapy are not only effective immediately after injection but also yield better results in long term.”
DISCUSSION (Cont..)

- In our study, two other patients had vascular malformation in lower limb, one in foot and other in thigh. Sclerotherapy was done using STS in both patients. There was complete clinical response with no complication, however they lost to follow up and later presented with recurrence of disease and symptoms.

- This signifies the fact that long term follow up is mandatory in PVMs for achieving marked clinical success. Patients who are lost to follow up may present with recurrence of symptoms.
DISCUSSION (Cont..)


- Our experience shows a very low risk of complication (7.1%) in patients with PVMs which is significantly lower as compared to the previous studies [2,4,5,6,7].
DISCUSSION (Cont..)

❖ Castren E et al. [8] published

“A series of 75 patients who underwent sclerotherapy for vascular malformations (VM) in the region of head and neck with 17.3% complication rate.”

❖ In another study, Berenguer B et al. [9] also reported significantly higher risk of complications after sclerotherapy in the treatment of facial vascular malformations.

❖ In our study we treated 5 patients with vascular malformations in the region of head and neck with significant improvement in pain, swelling and function without any complication.
DISCUSSION (Cont. ..)

- In literature, there is difference in the choice of sclerotherapeutic agents among different authors.
- We have used STS as sclerotherapeutic agent in most of our procedures as it is one of the effective and safest agent used for sclerotherapy with success rate comparable to ethanol [10,11].
- However, it can cause various adverse reactions such as sloughing and necrosis of tissues, skin discoloration and allergic reactions.
- Varcoe PF. [13] reported “The incidence of allergic reaction after STS injection ranges from 0.15 to 0.30%.”
- In our study, 1 patient developed allergic response to the test dose of STS after which its further use was abandoned in this patient and sclerotherapy was performed using glue with lipoidol.
DISCUSSION (Cont..)

- Results of our study demonstrated marked response in 71.4% of patients and partial response in 28.5% with 0% failure rate.
- With the mean follow up of 1.75 years, we conclude that sclerotherapy with or without embolization is safe and effective treatment modality however, it needs multiple sessions and long term follow-up.

Limitations:
- Retrospective study
- Small sample size.
PVMs are complex lesions. Sclerotherapy with or without embolization is a safe and effective treatment modality with clinical response approaching 100% and most of patients experiencing relief of symptoms.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Age, gender</th>
<th>Flow</th>
<th>Region involved</th>
<th>Symptoms</th>
<th>No of sessions</th>
<th>Agents used</th>
<th>Clinical response</th>
<th>Complications</th>
<th>Length of follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10 yrs, male</td>
<td>Low</td>
<td>Bilateral parapharyngeal spaces</td>
<td>Progressive dyspnea and dysphagia. Dyspnea aggravated during sleep resulting in inability to go into deep sleep.</td>
<td>2</td>
<td>STS</td>
<td>Complete response Resolution of pain</td>
<td>None</td>
<td>7 months</td>
</tr>
<tr>
<td>2.</td>
<td>16 yrs, female</td>
<td>Low</td>
<td>Planter and dorsal aspect of right foot</td>
<td>K/c right foot vascular malformation, pain in right foot</td>
<td>1</td>
<td>STS</td>
<td>Complete response resolution on dorsal and planter aspect.</td>
<td>Skin discoloration</td>
<td>4 months</td>
</tr>
<tr>
<td>3.</td>
<td>37 yrs, female</td>
<td>Low</td>
<td>Right parapharyngeal extending into larynx</td>
<td>Painless swelling in neck on right side for last 2 yrs that is progressively increasing in size</td>
<td>2</td>
<td>STS</td>
<td>Partial response</td>
<td>None</td>
<td>4 months</td>
</tr>
<tr>
<td>4.</td>
<td>23 yrs, female</td>
<td>Low</td>
<td>Posterior aspect of left calf</td>
<td>Pain in left leg for 10 yrs that was increasing in severity for last 2 yrs</td>
<td>1</td>
<td>STS</td>
<td>Complete response resolution of pain</td>
<td>None</td>
<td>2 months</td>
</tr>
<tr>
<td>S.No</td>
<td>Age, gender</td>
<td>Flow</td>
<td>Region involved</td>
<td>Symptoms</td>
<td>No of sessions</td>
<td>Agents used</td>
<td>Clinical response</td>
<td>Complications</td>
<td>Length of follow up</td>
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<tr>
<td>5.</td>
<td>31yrs, Male</td>
<td>Low</td>
<td>Lateral aspect of right elbow</td>
<td>Severe pain in right arm</td>
<td>3</td>
<td>STS</td>
<td>Complete response Resolution of pain.</td>
<td>none</td>
<td>3yrs</td>
</tr>
<tr>
<td>6.</td>
<td>35yrs, Male</td>
<td>High, Feeding vessels from left ophthalmic artery</td>
<td>Left eyelid</td>
<td>Ptosis of left eye Difficulty in opening eye with no visual impairment</td>
<td>1</td>
<td>Bleomycin</td>
<td>Partial response significant resolution.He was able to open his eye.</td>
<td>none</td>
<td>Lost to F/U.</td>
</tr>
<tr>
<td>7.</td>
<td>32yrs, male</td>
<td>Low</td>
<td>Right ankle</td>
<td>Pain in right ankle extending into calf</td>
<td>7</td>
<td>Glue with lipoidal</td>
<td>Partial response, 50% reduction in size on post procedure MRI</td>
<td>None</td>
<td>4yrs</td>
</tr>
<tr>
<td>8.</td>
<td>18yrs, female</td>
<td>Low</td>
<td>Multiple lesions in right lower limb</td>
<td>Pain in right leg</td>
<td>2</td>
<td>STS</td>
<td>Complete response Resolution of pain, on 2yr F/U size increasing</td>
<td>None</td>
<td>2 yrs</td>
</tr>
<tr>
<td>S.No.</td>
<td>Age, gender</td>
<td>Flow</td>
<td>Region involved</td>
<td>Symptoms</td>
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<tr>
<td>9.</td>
<td>18yrs, female</td>
<td>High</td>
<td>Left arm</td>
<td>Left arm, swelling</td>
<td>2</td>
<td>Glue with lipoidal, stenting</td>
<td>Complete response</td>
<td>none</td>
<td>3yrs</td>
</tr>
<tr>
<td>10.</td>
<td>22yrs, female</td>
<td>Low</td>
<td>Right distal thigh</td>
<td>Pain and swelling in right distal thigh since childhood increasing for 2-3 yrs</td>
<td>3</td>
<td>STS</td>
<td>Partial response, pain resolved, on 3yr F/U size increasing</td>
<td>none</td>
<td>3yrs</td>
</tr>
<tr>
<td>11.</td>
<td>20yrs, male</td>
<td>High,AVM</td>
<td>Face</td>
<td>Bleeding from gums</td>
<td>1</td>
<td>Coils with PVA and gelfoam</td>
<td>Complete response</td>
<td>None</td>
<td>3yrs</td>
</tr>
<tr>
<td>12.</td>
<td>17yrs, male</td>
<td>Low</td>
<td>Right arm</td>
<td>Pain on compression, swelling increasing in size</td>
<td>2</td>
<td>STS</td>
<td>Complete response</td>
<td>none</td>
<td>2yrs</td>
</tr>
<tr>
<td>S.No.</td>
<td>Age, gender</td>
<td>Flow</td>
<td>Region involved</td>
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</tr>
<tr>
<td>13.</td>
<td>18yrs, female</td>
<td>High</td>
<td>Face</td>
<td>Extensive vascular malformation on face</td>
<td>2</td>
<td>Coils with PVA</td>
<td>Complete response</td>
<td>none</td>
<td>3yrs</td>
</tr>
<tr>
<td>14.</td>
<td>22yrs</td>
<td>intermediate</td>
<td>Left forearm</td>
<td>Pain and swelling increasing in size for last 3 months</td>
<td>1</td>
<td>STS, glue with lipoidal</td>
<td>Complete response</td>
<td>none</td>
<td>1 month</td>
</tr>
</tbody>
</table>
CASES
REFERENCES


SUCCESS FOR MANKIND

- FAITH
- GOOD DEEDS
- CALLING EACH OTHER TOWARDS GOOD DEEDS.
- CALLING EACH OTHER TOWARDS PATIENCE.
Thank you
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