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Sclerotherapy for vascular malformations: Complications and a review of techniques to avoid them

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Summary *Purpose:* Interventional radiology has a principal role frequently replacing surgery in the multidisciplinary management of vascular malformations. Having noticed an initial high rate of complications, we examined our early experience to study in detail the outcomes and risks. We also present a review of techniques to reduce these complications.
Materials and methods: Data were collected during a 5-year period on patients who had completed treatment. The two sclerosants used were either 100% alcohol or 3% sodium tetradecyl sulphate (STS) as sole agents, or in combination. We graded early clinical and radiological outcomes. Binary logistic regression analysis was carried out for variables (age, type of vascular malformation and number of sclerotherapy sessions) that may predict the occurrence of complications.
Results: Twenty-four patients (11 males and 13 females) completed treatment during this period and were the subject of this review. There were a total of 46 sessions with an average of two (range: one to five). The mean and median ages were 36.2 and 38 years, respectively. Nineteen patients had venous malformations and five had lymphatic malformations. Most of the vascular malformations were in the head and neck region (66.7%). Although the overall early results were favourable (21 out of 24 patients had partial or complete resolution clinically and radiologically), there were four nerve-related and three skin-related complications. Using alcohol alone (13 patients, 24 sessions) there were one skin and three nerve injuries; with STS alone (five patients, 19 sessions) there was one skin complication; and when in combination (six patients, three sessions) one nerve and one skin complications.

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Conclusion: More complications were seen with the use of alcohol, including all the nerve-related injuries, prompting a change of practice to favour STS as the primary agent, especially for head and neck lesions.

Vascular malformations are structural abnormalities of the vascular system present from birth and sub-classified by their vessel type (arterio-venous, capillary, venous and lymphatic).

The main treatment for venous malformations (VMs) and lymphatic malformations (LMs) is symptom control and may involve injection sclerotherapy since high morbidity and recurrence rates following operative intervention are well documented.[1] Intervention for pain or deformity using sclerotherapy is often the first choice of treatment for VM, while surgery or sclerotherapy may be the first treatment option for LM.[2,3] The choice of treatment is best discussed within a multidisciplinary team (MDT)[4] and injection sclerotherapy needs to be performed by interventional radiologists.

A multidisciplinary service was established in our hospital, which treated mostly adults. A review into the initial practice of injection sclerotherapy for the treatment of vascular malformations was undertaken for patients treated in a 5-year period between 2004 and 2009 because of concerns of the complications.

Materials and methods

This study was a retrospective one and case records of patients were reviewed for demographic details, clinical/radiological diagnoses, site, tissue involved, number of sclerotherapy sessions, agents, complications and early outcome data that were put on a database and statistical analyses carried out with Microsoft Excel®. Table 1 shows the patient data. Binary logistic regression analysis was carried out using Statistical Package for the Social Sciences (SPSS®) version 12 for Windows for variables that may predict occurrence of complications. A p-value of <0.05 was taken for statistical significance. Our institutional review board approved the conduct of this study.

The diagnoses were made using clinical and radiological, magnetic resonance imaging (MRI) and ultrasound scan (USS), means and, for some patients, treatment with interventional radiology was recommended. Two patients had angiograms, while 13 had venograms. The presence of low flow pattern in patients with VM and cystic pattern without flow in LMs were confirmed with USS before starting treatment. The venographic appearances of the injected VMs were classified according to previous descriptions by Berenguer et al.[5] and later by Abernethy.[6]

One interventional radiologist (M.B) carried out sclerotherapy under fluoroscopic or USS guidance in the angiographic suite under either a general or a local anaesthetic. Appropriate volumes of the sclerosant, either pure alcohol and/or 3% sodium tetradecyl sulphate (STS) (Fibro-Vein, STD Pharmaceutical Products Limited), were injected percutaneously using 21G 'butterfly' needles after confirming entrance into a vascular space by retrograde blood flow (digital pressure was performed if necessary). For STS, a three-way connector was used. The volume of contrast used to fill the VM is replaced with equal volume of STS mixture (2 ml water-soluble contrast, 2 ml STS and 6 ml of air) (Figure 1). For alcohol, on the other hand, no air was used and the exact volume injected was replaced with alcohol. If a draining vein was seen, an attempt was made to compress it manually or by tourniquet to maximise contact with the malformation and to reduce systemic complications of the sclerotherapy. If a tourniquet was used, we ensured that only small volumes of the sclerosant were injected to avoid cardiac toxicity including cardiac arrest. The tourniquet was then gradually removed to avoid sudden systemic release of the sclerosant.

For LMs, the lesion was punctured and its contents were first emptied and then replaced with an equal volume of sclerosant (alcohol or STS), and left for approximately 5 min. The sclerosant was then withdrawn leaving only a small residual volume. If multiple loculi are present, then USS was used to guide access to each.

We had the following definitions of response:

(1) Complete clinical response: Absent visible abnormality and resolution of pain.
(2) Partial clinical response: Reduction in the size of the anomaly or pain by more than 50%.
(3) No clinical response: Unchanged size and pain.
(4) Complete radiological response: Disappearance of the anomaly or vascularity of the VM on USS.
(5) Partial radiological response: Reduction in size or vascularity of VM by more than 50% on USS.
(6) No radiological response: Unchanged size or vascularity on USS.

Patients with head and neck malformations, who were assessed before the procedure and found to be at significant risk of airway obstruction, were electively managed in the intensive therapy unit after sclerotherapy. Dexamethasone was used prophylactically in the 16 head and neck cases.

Forty-seven patients were referred for injection sclerotherapy, of which only 25 completed the treatment (the remaining 22 either were not found suitable for the treatment or chose to defer/decline treatment). Of the treated 25 patients, one was later found not to have a vascular malformation but non-involuting congenital haemangioma (NICH)[7] and was excluded from data analysis. The remaining 24 patients who were analysed completed sclerotherapy.

Six weeks after sclerotherapy the patients were re-evaluated, both clinically and using USS/colour Doppler, to