CASE REPORT

Under pressure: progressively enlarging facial mass following high-pressure paint injection injury

Jameel Mushtaq, Abigail Walker, Ben Hunter

St George's University of London, London, UK

Correspondence to
Jameel Mushtaq,
m1000397@sgul.ac.uk

Accepted 5 January 2016

SUMMARY

High-pressure paint injection injuries are relatively rare industrial accidents and almost exclusively occur on the non-dominant hand. A rarely documented complication of these injuries is the formation of a foreign body granuloma. We report a case of a 33-year-old man presenting with extensive facial scarring and progressive right paranasal swelling 7 years after a high-pressure paint injury. After imaging investigations, an excision of the mass and revision of scarring was performed. Access to the mass was gained indirectly through existing scarring over the nose to ensure an aesthetic result. Histological analysis revealed a florid granulomatous foreign body reaction to retained paint. To the best of our knowledge, this is the first reported case of a facial high-pressure paint injury with consequent formation of a foreign body granuloma.

BACKGROUND

Industrial accidents involving high-pressure paint sprayers are rare but potentially catastrophic. Owing to vocational factors, these injuries predominantly occur to the non-dominant hand. Under high pressure, paint can penetrate the skin and disperse through subcutaneous tissues leading to fibrosis and ischaemia. A rarely documented long-term complication of these injuries is a foreign body granuloma, which may present a diagnostic challenge. We report the investigation and surgical management of the first reported foreign body granuloma caused by a facial high-pressure paint injection injury. In addition, we briefly review the pathophysiology, management and prognosis of high pressure injection injuries and foreign body granulomas.

CASE PRESENTATION

A 33-year-old Caucasian man presented to the Ear, Nose and Throat clinic, with a progressively enlarging right paranasal swelling extending from the right side of the nose to the medial canthus, which was starting to cause discomfort and obstruct vision from the right eye (figure 1). He described an industrial accident to the area—7 years prior, while trying to unblock a high-pressure paint sprayer—which was managed conservatively. The paint was believed to be emulsion paint, however, the operating pressure of the sprayer was unknown. The accident left him with hypertrophic and abnormal scarring over the right ala and the dorsum of the nose. On examination, the swelling was firm, and flexible nasoendoscopy showed no abnormal nasal

Figure 1 Anterior view of face. Arrow (→) points to mass and asterisk (*) highlights hypertrophied scars. Inferior view of face. Arrow (→) points to mass and asterisk (*) highlights hypertrophied scars. Note that the mass obstructs the patient's inferonasal field of view.

architecture. The patient was otherwise healthy and further history was unremarkable.

INVESTIGATIONS

Initial CT imaging indicated a minimally calcified venous malformation on the right cheek arising from the angular and facial veins (figure 2), and an ultrasound scan was recommended for further assessment. The ultrasound scan (US) demonstrated

Figure 2 CT scan illustrating a lesion in proximity to the right angular vein. The lesion is circled and the arrow (→) points to the right angular vein.

CrossMark

To cite: Mushtaq J, Walker A, Hunter B. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-212817

Figure 3 Ultrasound scan of the right cheek illustrating a subcutaneous mass extending from the right medial canthus.

a lobular lesion measuring $3.7 \times 2.3 \times 1.2$ cm, confined to the subcutaneous layer (figure 3). Some internal vascularity was demonstrated on Doppler scanning, however, the aetiology of the mass was uncertain, therefore a definitive diagnosis using biopsy was advised.

DIFFERENTIAL DIAGNOSIS

The differential diagnoses for a firm facial subcutaneous mass are:

- ▶ Sebaceous cyst
- ▶ Post-traumatic osteoma or osteochondroma
- ▶ Venous malformation
- ▶ Foreign body granuloma

Owing to the history of a conservatively managed high-pressure paint injury, there was a high index of suspicion for a foreign body granuloma. CT scanning raised the possibility of a venous malformation, however, the likelihood of this was reduced after US scanning. In addition, although exceedingly rare, extraskeletal osteomas and osteochondromas were a possible differential as they may form at sites of soft tissue injury¹ and progressively enlarge over time.² The CT scan indicated a minimally calcified lesion and subsequent US scan demonstrated a lobular mass, which reduced the likelihood of a bony tumour.

Figure 4 Intraoperative photograph of surgical access gained through existing transverse nasal scar and exploration of subcutaneous tissue in the right maxillary area.

Figure 5 Intraoperative photograph of excision of granulomatous mass.

TREATMENT

The aims of treatment were to gain a definitive diagnosis, reduce the size of the lesion to improve function, and to improve cosmesis. An indirect surgical approach was used, with access to the mass gained through existing facial scars (figure 4). Intraoperative finding was a dense fibrotic mass accounting for previous CT findings (figure 5). The mass was excised and samples were sent for histological analysis. The scars were revised for an aesthetic result (figure 6).

Figure 6 Immediate postoperative photograph showing final result with revision of scarring.

Figure 7 Histological slide of a tissue sample showing black pigment particles, clear birefringent particles and giant cells, indicative of a foreign body granuloma.

OUTCOME AND FOLLOW-UP

The histology report confirmed a florid foreign body reaction to black pigment particles and fragments of positively birefringent material (figure 7). As the mass was not malignant, a post-operative CT was not carried out. After a 2-week follow-up the patient had noticed an improvement in pain and vision. He was satisfied with the cosmetic result from the revision of scarring. The case has been followed up for 12 months with no significant recurrence.

DISCUSSION

High-pressure paint injuries are part of a wider class of uncommon occupational injuries called high-pressure injection injuries. The most commonly injected materials are paint, hydraulic fluid, water and grease—normally occurring on the index finger of the non-dominant hand.³ The initial injury is often small, however, the injected material can track widely through subcutaneous tissue, leading to a dual mechanism of damage. Direct trauma causes high-pressure necrosis, which may be further compounded by an inflammatory response caused by chemical toxicity.⁴ The symptoms and prognosis are dependent on the toxicity, pressure and volume of the material as well as the expansile capacity of the tissue compartment.³ In general, an aggressive treatment approach is advocated including an expert surgical opinion in all cases.^{5–7} In injuries to the hand, the long-term prognosis is poor with few returning to work due to loss of function caused by fibrosis.⁸

In contrast to injuries to the hand, there are few reports of high-pressure injection injuries to the face,^{9 10} and only one ophthalmological case involved paint.¹¹ In one case of an acutely presenting high-pressure grease gun injury, the pressures involved were high enough to allow penetration through the maxillary sinus and into the infratemporal fossa.⁹ The injuries sustained in our case were not as severe, which may be due to the lower operating pressure of the paint sprayer or due to the tangential direction of the injury. This can be deduced from the more medial distribution of scarring compared to the subcutaneous granuloma.

There are few reports of foreign body granulomas forming after high-pressure paint injection injuries. The granulomas may present a diagnostic challenge as in one case the granuloma was initially misdiagnosed as a giant cell tumour of the tendon sheath even after biopsy and histological analysis.¹² The three

main constituents of paint are vehicle, solvent and pigment. The vehicle and solvent evaporate to leave behind the pigment, which is identified as dark particles in our tissue sample (figure 7). Granulomatous reactions to a wide variety of pigments have been extensively reported in the context of tattoos, both medical and non-medical, and are believed to be immune reactions to metallic ions present in the pigment.^{13 14} In addition to pigment particles, there are clear birefringent particles in the granuloma (figure 7) that may be talc particles, added to give the paint a matte appearance.¹² Talc is well known to cause the formation of foreign body granulomas when inhaled^{15 16} or injected intravenously,¹⁷ and may enhance the inflammatory response in this case. In general, the formation of foreign body granulomas consists of a chronic immune response to foreign particles too large to be phagocytosed. The sequence of events includes protein adsorption, macrophage adhesion, macrophage fusion and the formation of giant cells,¹⁸ which are visible in our tissue sample (figure 7).

Mason and Queen¹⁹ describe the experience of Hesse in treating 183 ‘artificial granulomas’ caused by Russian conscripts self-injecting various oils in order to avoid military service during the revolutionary era. In particular, the difficulties in surgical management due to the intimate association with neurovascular structures and difficulties in achieving haemostasis were noted. Recently, non-operative techniques for foreign body granulomas caused by cosmetic fillers have been described, including injectable bleomycin, anti-mitotics and steroids, in addition to systemic therapies and pulsed lasers.^{20–22} However, there is currently no clear consensus on the optimal therapy. In one series of 173 cases, surgical management was shown to be superior to injectable therapies for the management of facial foreign body granulomas caused by fillers. The authors concluded that surgical management was optimal for large facial granulomas that were having a significant impact on cosmesis, or for cases refractory to injectable treatment.²³ The aforementioned treatment modalities are advocated for management of foreign body granulomas caused by dermal fillers, however, it is not clear whether the same modalities should be used in foreign body granulomas caused by high-pressure injection injuries, as these may be located deeper and involve a greater volume of material. The long-term prognosis of untreated granulomas is poor, as fistulae, fibrosis and scarring eventually occur.^{19 22} Unfortunately, there is a relatively high rate of recurrence in foreign body granulomas treated both operatively and non-operatively.²³

To conclude, high-pressure paint injuries require specialist acute management. The mechanism of damage is both traumatic and inflammatory, leading to long-term sequelae. Retained

Learning points

- ▶ Acute high-pressure paint injuries require treatment as a surgical emergency.
- ▶ The prognosis is variable and depends on the pressure, site of injury, type and amount of material.
- ▶ Injected material can disperse widely from the point of entry, which may pose challenges to surgical management.
- ▶ Retained paint may cause a granulomatous foreign body reaction that can present many years after the initial injury.
- ▶ Granulomas may be managed using non-operative or operative treatment, however, there is little consensus on the optimal treatment strategy.

material can cause foreign body granulomas that may present many years after the initial injury. The treatment of granulomas is complex and there is currently no consensus on the optimal strategy. There are limited reports of facial high-pressure paint injuries and this is the first to report a long-term complication.

Contributors JM, AW and BH contributed to the design, data collection, write-up and review of the final article.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- Cutilli BJ, Quinn PD. Traumatically induced peripheral osteoma. *Oral Surg Oral Med Oral Pathol* 1992;73:667–9.
- Sayan NB, Üçok C, Karasu HA, et al. Peripheral osteoma of the oral and maxillofacial region: a study of 35 new cases. *J Oral Maxillofac Surg* 2002;60:1299–301.
- Hogan CJ, Ruland RT. High-pressure injection injuries to the upper extremity: a review of the literature. *J Orthop Trauma* 2006;20:503–11.
- Wei DH, Strauch RJ. High-pressure injection injuries. In: Rozmaryn LM, edr. *Fingertip injuries*: Springer International Publishing; 2015:73–81.
- O'Sullivan S, Beausang E, O'donoghue J, et al. The importance of open wound management in high-pressure injection injuries of the upper limb. *J Hand Surg* 1997;22:542–3.
- Wong TC, Ip FK, Wu WC. High-pressure injection injuries of the hand in a Chinese population. *J Hand Surg* 2005;30:588–92.
- Sarwar U, Javed M, Rahman S, et al. Digital high-pressure injection injury: the importance of early recognition and treatment. *BMJ Case Rep* 2014;2014:pii: bcr2013203206.
- Wieder A, Lapid O, Plakht Y, et al. Long-term follow-up of high-pressure injection injuries to the hand. *Plast Reconstr Surg* 2006;117:186–9.
- Ishinaga H, Shimizu T, Majima Y. High-pressure grease injury of the face. *Am J Otolaryngol* 2004;25:278–81.
- Goel N, Johnson R, Phillips M, et al. Grease gun injuries to the orbit and adnexa. *Ophthal Plast Reconstr Surg* 1994;10:211–15.
- Yip CC, Tan DT, Balakrishnan V, et al. High-pressure paint gun injury to the orbit and ocular adnexa. *Int Ophthalmol* 1998;22:335–9.
- Stefanato CM, Turner MS, Bhawan J. High-pressure paint-gun injury of the finger simulating giant cell tumor of tendon sheath. *J Cutan Pathol* 2005;32:179–83.
- Haddad C, Webb FJ, Haddad-Lacle J. Delayed complication from a tattoo. *Am Fam Physician* 2012;86:669–70.
- Kazandjieva J, Tsankov N. Tattoos: dermatological complications. *Clin Dermatol* 2007;25:375–82.
- Johnson DC, Petru A, Azimi PH. Foreign body pulmonary granulomas in an abuser of nasally inhaled drugs. *Pediatrics* 1991;88:159–61.
- Oubeid M, Bickel JT, Ingram EA, et al. Pulmonary talc granulomatosis in a cocaine sniffer. *Chest* 1990;98:237–9.
- Nguyen VT, Chan ES, Chou SH, et al. Pulmonary effects of i.v. injection of crushed oral tablets: excipient lung disease. *AJR Am J Roentgenol* 2014;203:W506–15.
- Anderson JM, Rodriguez A, Chang DT. Foreign body reaction to biomaterials. *Semin Immunol* 2008;20:86–100.
- Mason ML, Queen FB. Grease gun injuries to the hand-pathology and treatment of injuries (oleomas) following the injection of grease under high pressure. *Quart Bull Nthwest Univ Med Sch* 1941;15:122.
- Reisberger EM, Landthaler M, Wiest L, et al. Foreign body granulomas caused by polymethylmethacrylate microspheres: successful treatment with allopurinol. *Arch Dermatol* 2003;139:17–20.
- Lemperle G, Gauthier-Hazan N, Wolters M, et al. Foreign body granulomas after all injectable dermal fillers: part 1. Possible causes. *Plast Reconstr Surg* 2009;123:1842–63.
- Lee JM, Kim YJ. Foreign body granulomas after the use of dermal fillers: pathophysiology, clinical appearance, histologic features, and treatment. *Arch Plast Surg* 2015;42:232–9.
- Park TH, Seo SW, Kim JK, et al. Clinical outcome in a series of 173 cases of foreign body granuloma: improved outcomes with a novel surgical technique. *J Plast Reconstr Aesthet Surg* 2012;65:29–34.

Copyright 2016 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow