Non-operative management of water injection injury to the neck

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Abstract

Although rarely reported in the pediatric population, high-pressure injection injuries are a common occurrence in adult industrial workers. These injuries commonly exhibit physiologic patterns consistent with direct kinetic trauma, localized substance toxicity, and in later stages infection. The majority of reported cases describe injection injuries caused by caustic substances at high pressures frequently necessitating debridement. In this case, we present a 12-year old boy who sustained a Zone III penetrating neck injury after running in front of a commercial pressure washer. In our case presentation there was concern for vascular and aero-digestive injuries; however, following physical examination and advanced imaging, expectant management was successfully adopted.

Keywords

Neck trauma; Injection injury; Non-operative management of neck injuries; Pressure washer injury

The development of high-pressure water sprays for commercial and home use has led to similar reports of injury to the abdomen, extremities, and the head and neck [1–3]. Industrial water sprays are capable of generating up to 55,000 psi of force. Home pressure-washers can generate several thousand psi of force-enough energy to infiltrate water, air, and debris into tissue. As with industrial injection injuries, the damage is often underestimated on the basis of physical exam alone. Nevertheless, there are reports of major vascular trauma and penetrating intra-abdominal wounds from water sprays [3,4]. High-pressure injuries have routinely been considered surgical emergencies. However, with improvement in diagnostic studies and the availability of closely monitored hospital units, non-operative management of select cases has been reported [1,4]. In this case, we report a water injection injury to Zone III of the neck that was managed non-operatively.

1. Case report

A 12-year old boy presented to a community hospital after running across the stream of a commercial pressure washer (3000 psi) being operated by his parents. He was immediately taken to the ED of a local community hospital after his parents reported seeing blood
“squirt” out of the right side of his neck. The patient was transferred to a tertiary care facility to address the concern of an expanding hematoma.

On presentation to Albany Medical Center, the patient was hemodynamically stable, awake, alert, and without any gross neurological deficits. There was a marked absence of stridor, dyspnea, or other signs to suggest the airway had been compromised. Edema and crepitus were present along the right side of the face and mandible with extension inferiorly through the neck (Fig. 1). An 8 cm abrasion as well as two small puncture sites were present just superior to the mandible within Zone III. The patient’s right ante-brachium had a 10-cm superficial abrasion, consistent with defensive gesturing (Fig. 2). His vaccinations including tetanus prophylaxis were up to date. At this time intravenous broad spectrum antibiotics were initiated.

Due to the patient’s stable initial survey, imaging studies were obtained. Computed tomography angiography demonstrated subcutaneous emphysema in the right side of the neck, superficial to the sternocleidomastoid muscle (Fig. 3). There was no extravasation of contrast or other evidence of vascular injury. Duplex ultrasonography of the carotid arteries demonstrated no gross abnormalities. Subsequently, an upper gastrointestinal series did not reveal any perforations of the esophagus.

The patient was started on 48 h of intravenous broad spectrum antibiotics while being monitored in the pediatric intensive care unit. Following his short stay, he was discharged home in stable condition without having required operative intervention.

2. Discussion

The case described in this report details the non-operative management of a high-pressure water injection injury to Zone III of the neck. Once considered a surgical emergency, such injuries are increasingly being managed non-operatively [4,5]. Several factors must be considered in the selection of patients for conservative management.

Despite the importance of the physical exam, external injuries often do not reflect the magnitude of underlying tissue damage. As a result, the extent of injury is often underestimated [6]. The high pressures of many commercial washers are capable of injecting significant amounts of water and air deep into tissue—resulting in dissection of underlying fascial planes and damage to neurovascular structures [6–9]. The extent of injury is poorly reflected on the surface with subcutaneous emphysema and edema being common findings [4,5,9]. In our case, the patient displayed a relatively small punctuate wound. Prompt neurovascular exam using appropriate imaging modalities along with assessment of compartment pressure is vital to characterizing the true degree of damage [6]. If injury to either aero-digestive or neurovascular structures cannot be ruled out through physical examination and imaging, wound exploration may be necessary [1,2].

Medical therapy of water injection injuries includes broad spectrum antibiotic therapy and tetanus vaccination. The introduction of nonsterile water into tissue raises the concern of infection from a variety of organisms found in soil and freshwater supplies including *Aeromonas hydrophila*, *Acinetobacter calcoaceticus* and *Corynebacterium aquaticum* [2,10].
Antibiotic therapy must be sufficient to cover these organisms in addition to normal skin flora. Wound cultures are also recommended in case infection does develop. In our case, the patient was started on IV antibiotics for the 48 h he remained hospitalized and oral antibiotics for 7 days following discharge.

3. Conclusion

The majority of reported cases of high-pressure injection injuries are managed with wound exploration and debridement in the OR [5]. In this report, we describe the non-operative management of a high-pressure injection injury to Zone III of the neck. Improvements in imaging technology as well as the availability of closely monitored units are leading to increasing rates of non-operative management in a variety of trauma cases. Given the conflicting guidelines and the complexities inherent to neck trauma, we have developed a high-pressure injection neck injury treatment algorithm [11] (Fig. 4).

In this case, the managing team recognized that the patient was hemodynamically stable and without hard clinical signs of aero-digestive injury. It was subsequently determined that the patient may be able to avoid an operation if imaging could effectively rule out neurovascular and aero-digestive damage and the patient did not clinically deteriorate. The patient did well and was discharged 48 h later. In conclusion, our case demonstrates that in select hemodynamically stable trauma patients, non-operative management is an appropriate and potentially superior treatment modality.

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Fig. 1.
Puncture wounds in Zone III of the neck.
Fig. 2.
Forearm abrasions.
Fig. 3.
Coronal and transverse CT angiogram views demonstrating subcutaneous emphysema.
Fig. 4.
Suggested management algorithm for high-pressure injection injury to the neck.