Updates from the WorkSafeBC

High-pressure injection injuries

Looks can be deceiving

High-pressure injection injuries, while relatively rare, can be devastating if neglected or inappropriately treated. Between 1999 and 2008, three claims for injection injury were submitted to WorkSafeBC: one eventually resulted in amputation of a finger, and the other two, despite surgical debridement, resulted in chronic pain.

The causes

Equipment such as paint or grease guns, cement injectors, diesel fuel jets, hydraulic lines, and plastic injectors capable of emitting enough pressure to breach the human skin and inject contents into the human body can cause workplace high-pressure injection injuries. Only 100 pounds per square inch (psi) is required to break intact human skin.

The three most commonly injected substances are grease, paint or paint solvents, and diesel fuel. Other substances include water, air, hydraulic fluids, cement, and vaccines.

First aid

Workers with injection injuries may experience little or no pain at the time of the incident. Entry wounds are frequently small or insignificant. However, unless proven otherwise, injection injuries must be treated as surgical emergencies.

First aid at the worksite should include identification of the injected material and immediate transport to an emergency department.

Emergency treatment

Often, workers with injection injuries present late to an emergency department and may not connect the earlier use of high-pressure equipment with pain symptoms. Patients may present with numbness, burning, pain, or swelling that progresses over time.

While grease gun injuries may result in no pain initially and no generalized inflammation unless secondary infection occurs, solvent injection produces intense pain with both local and systemic response. Air may cause crepitus with subcutaneous emphysema.

When early signs are ignored and patients do not receive appropriate treatment, pain, which responds poorly to analgesics, intensifies with time. Gangrene may be seen as early as 4 days postinjury.

Given the potential range of presenting signs and symptoms, careful history-taking is essential. Once high-pressure injection has been identified as the likely cause of injury, the time of injury, operating pressure of the equipment involved, and type and estimated quantity of material injected should all be identified. The nature of injected materials should be investigated further, including consultation with a poison centre if necessary.

Emergency room tetanus immunization and broad spectrum antibiotics prophylaxis are recommended, along with elevation and splinting of the injured body part.

Local exploration, extravasation of the injured body part, application of a tourniquet, or injection of local anesthetics (such as digital blocks) should *not* be attempted. Solvents or agents other than saline should *not* be used to irrigate the wound or push fluid to the outside. Incision for decompression and application of ice to reduce swelling should also *not* be attempted.

Radiographs are helpful in determining the spread of the injected material, either by the presence of radio-opaque signal or evidence of radiolucent material or injected air.

For most high-pressure injection injuries, surgical debridement is indicated to decompress the vascular system, decrease infection risk, and excise the injected material as much as possible. Wide and multiple debridements may be needed depending on the wound. Early amputation may be appropriate if an affected finger has vascular compromise at presentation. Especially within 24 hours postsurgery, watch for signs of secondary infection.

For finger injury, palmar splinting in the intrinsic-plus position for 5 days and passive mobilization is recommended. Intensive physiotherapy, including passive mobilization, active mobilization, and strength exercises, may be required for up to 12 months.

Outcomes

Outcomes of injection injury depend on multiple factors, including the nature and volume of the injected material, pressure of the injection, site of the injection, and time between injury and adequate treatment.

Amputation rates vary between 16% and 48%, with 30% overall risk of amputation. Finger injections have a higher rate of amputation (47%) compared with thumbs (15%) or more proximal injury to the palm or dorsum of the hand (25%). Patients with secondary infection—usually polymicrobial in nature and despite IV antibiotics—have an amputation rate as high as 31%. Those who sustain injury under 1000 psi have a 19% amputation rate, while the rate for those with injury more than 1000 psi increases to

43%. There appears to be no threshold pressure above which amputation is inevitable.

In general, early surgical debridement does not always prevent amputation. However, among patients who sustain injection of paints, paint thinner, gasoline, automotive undercoating, jet fuel, oil, or organic solvents the rate of amputation is less when debridement occurs within 6 hours' postinjury.

Prompt recognition of the seriousness of a high-pressure injection injury and urgent surgical exploration and decompression may reduce the risk of permanent sequelae.

Marine puncture wounds

Spines can be toxic

Workers in the fin-fish and seafood harvest industries in BC must wear personal protective equipment to prevent toxic-spine puncture injuries. In BC waters the sharp spines of dogfish, ratfish, rockfish, and sea urchins have varying degrees of toxicity. Spines can pierce gloves, boots, oil skins, and hats and cause serious injury, and bacteria in spines and fish slime are serious infection hazards.

Between 1999 and 2008 there were 102 WorkSafeBC claims for marine puncture wounds. Of those, 84% of claimants suffered puncture or open wounds in hands or fingers. The majority were workers in the fishing industry; a smaller number were in the supermarket industry. Most received only wage loss for a median 9 days (with a mean of 43 days), but 7% of the injured workers were on long-term disability.

Marine puncture wounds can lead to serious or life-threatening infections as well as tissue destruction and loss of joint mobility.

First aid

First aid for a marine puncture wound should start immediately with rinsing of the wound with soap and water. Unless anaphylaxis is developing, do not apply a tourniquet or pressure to the wound.

Hot water immersion (40 º to 45 ºC) for 30 to 90 minutes or longer may help to relieve pain.

Treatment

Spines are fragile and often break during removal attempts, leaving fragments in the tissue. Location and surgical removal of embedded spines are important as the presence of spines can lead to chronic synovitis or granulomas.

A purple dye released by the spines may give the appearance that spines are still embedded under the skin. This dye is not toxic and will be absorbed in a few days.

X-ray imaging for spine fragments may be inconclusive due to calcium resorption and ultrasound or MRI may be indicated.

A puncture wound that enters the joint space is especially critical, and early, aggressive intervention is essential to prevent loss of function. Fluoroscopy is recommended for spine extraction. To limit further injury, splint the joint until it can be explored by a specialist. Exploration should take place in an operating room, not the emergency department.

Monitor for signs of infection or toxicity. A delayed hypersensitivity-type reaction may occur days, even weeks, after injury.

Prophylactic antibiotics are indicated for deep puncture wounds but are otherwise not warranted for healthy persons with non-infected, superficial marine wounds.

Consider a tetanus toxoid booster if more than 5 years has elapsed since the patient's last immunization.

When submitting specimens for culture, be sure to indicate that the source is a marine wound to inform the lab to test for marine-specific organisms.

For more information

For more information on high-pressure injection or marine puncture injuries please contact a medical advisor in the WorkSafeBC office nearest you.

References for the information provided are available on request.

—WorkSafeBC Evidence Based Practice and Outcome Research Group (www.worksafebc.com/evidence)
—Craig Martin, MD, MHSc
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REMINDER

Annual WorkSafeBC Physician Education Conference
Saturday, 24 October 2009
at Laurel Point Inn in Victoria

- **Dr Colin Landels:** Shoulder injuries
- **Dr Lee Glass:** The dreaded discussion: How to have it and come away pleased with the outcome
- Opioids and the patient in pain: Panel discussion with views from a family doctor, physiatrist, addiction medicine specialist, and WorkSafeBC chief medical officer

Interactive workshops:

- Upper-extremity trauma
- Lower-extremity trauma
- Physical examination of the back
- Physical examination of the shoulder
- Pearls and pitfalls of returning your patient to work
- Fitness to work in safety-sensitive jobs
- Occupational cancers
- Worksite assessment, Laurel Point Inn pastry kitchen

For updates visit worksafebc.com/news_room/conferences