



UNIVERSITY OF CALGARY

University of Calgary

PRISM: University of Calgary's Digital Repository

Alberta Occupational Medicine Newsletter

Articles in the Alberta Occupational Medicine Newsletter

1997

High Pressure Injection Injuries of the Hand

Flotre, Murray

<http://hdl.handle.net/1880/43260>

journal article

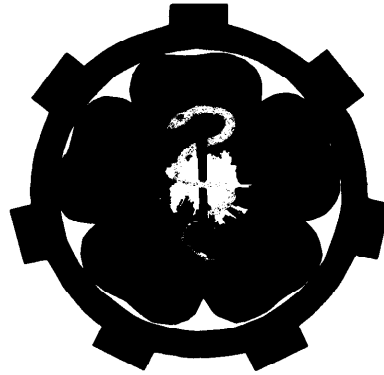
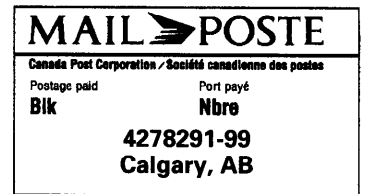
<http://creativecommons.org/licenses/by-nc-nd/2.5/>

Attribution Non-Commercial No Derivatives 2.5

Downloaded from PRISM: <https://prism.ucalgary.ca>

RETURN ADDRESS:

Editor, Alberta Occupational Medicine Newsletter
Dept. of Community Health Sciences
Faculty of Medicine
University of Calgary
3330 - Hospital Drive N.W.
Calgary, Alta., T2N 4N1 Canada



VOL. XIV, No. 1

SPRING 1997

ALBERTA OCCUPATIONAL MEDICINE NEWSLETTER

EDITORIAL COMMENTS

This first issue of 1997 begins with an article by Dr. Sally Nikolaj of the Alberta Workers' Compensation Board. She outlines a number of strategies the Board is implementing for the medical management of occupational injuries. Readers are referred to the Winter 1996 issue of the Newsletter for additional information on the Medical Guidelines projects. Alberta WCB has also launched its own newsletter titled *Health Care Matters* on a trial basis for designated health care providers in Alberta. Inquiries can be directed to Kelly Eby (editor) at 498-8685 (phone) or 427-5923 (fax).

Two short articles then follow, one describing the irritant and allergic effects of cyanoacrylate glues, the other stressing the importance of prompt surgical assessment of high pressure injection injuries to the hand. Even a glancing pass of a high pressure carwash spray (speaking from personal experience) can lead to painful skin injuries that take a surprisingly long time to heal.

Our big news is the launching of a website through the BACS Learning Centre at The University of Calgary. Intended primarily for Alberta physicians, medical students and residents, we hope this collection of informational pages and links to other websites will serve as a valuable

electronic 'desktop reference' in occupational medicine, current events, medical guidelines, government documents, related professional associations, and past newsletter articles. Please have a browse, and send us your comments. Kim Blaikie and Doug Hall at The University of Calgary deserve the credit for handling the technical aspects of development and evaluation of this website.

Kenneth Corbet MD FRCPC
Editor

* * *

THE ALBERTA WORKERS' COMPENSATION BOARD HEALTH CARE STRATEGY

Sally Nikolaj, PhD*

The WCB relies upon community health care services for the treatment of injured workers. The specific type and quantity of health care service required is dependent upon the nature and complexity of the injury (e.g. muscle strain, fracture, head injury, etc.) and the progress which has occurred since the injury. At the present time, the WCB uses the services of over 24,000 different health care providers including, but not limited to: physicians, physical therapists, chiropractors, psychologists, dentists, acupuncturists,

orthotists and prosthetists, work hardening programs, chronic pain programs, and brain injury programs. Annual health care expenditures for 1995 were approximately \$71 million, which represents approximately 25% of total yearly claims costs.

Prior to 1992, the WCB exercised little control over the quality or cost of health care services. As a result, the WCB and its clientele of injured workers and employers were, in some cases, subjected to unreasonable pricing, inappropriate or protracted service delivery, adversarial interactions, and less than a positive business relationship with health care providers. In addition, the Board, until recently, had little information regarding the contribution of health care intervention to a timely and safe return to work, given that there has been no consistent analysis of the benefit of health care services relative to expenditures. Over the past three years, the WCB has systematically implemented mechanisms for gaining greater control over our use of specific Health Care Services. This has been augmented by the introduction of comprehensive strategy for the management of all health care providers used by the WCB and for the internal processes related to health care decision making.

The objective of the WCB Health Care Strategy is to *secure high quality, fair priced Health Care Services for*

Prepared in the Department of Community Health Sciences, Faculty of Medicine
The University of Calgary, through funding by The Workers' Compensation Board - Alberta

appropriate and timely treatment of injured workers to facilitate their fitness to work. The primary components of this strategy are as follows:

1. Disability Management Tools

(a) Continuum of Care Models

The WCB is developing a series of Continuum of Care Models which are specific to injury categories (i.e. soft tissue injuries, spinal cord injuries, repetitive strain injuries, head injuries, burns, industrial disease, occupational stress). These models will identify the type of health care treatment that is most appropriate at different stages in the healing process of a specific injury. A rigorous process is being followed in the development of the Continuum of Care Models including: review of all related literature, consultation with external and internal experts, and validation with the health care community. The resulting models are intended to be used by the WCB as decision making tools in determining the appropriate health care services given the type and complexity of a client's injury and the progress which has occurred since the injury. The Continuum of Care Models are also critical to the identification of health care service needs and the determination of outcome and services standards for providers.

Initial emphasis has been placed upon the development and implementation of a Soft Tissue Injury Continuum of Care Model (attached), as this type of injury represents approximately 60% of total WCB claims. During 1996, the WCB anticipates completion of Continuum of Care Models for Repetitive Strain and Mild Brain Injury.

(b) Medical Advisory Guidelines

WCB Medical Services, in conjunction with the medical community and the University of Alberta, is developing Medical Advisory Guidelines that reflect the most up to date information for the medical management of

specific conditions. The guidelines are valuable tools for communication within the WCB, as well as with community physicians and health care providers. They outline WCB expectations regarding medical diagnosis and treatment of injured workers. In addition to encouraging consistency, the guidelines also provide criteria and standards that can be assessed in determining the quality and costs associated with medical service delivery.

(c) Case Management Protocols

In 1995, the WCB Alberta completed development of case management protocols for use on their injury claims. These protocols provide a standardized method of documenting information and prompt critical action needed to effectively manage a claim. The protocols lead the Case Manager from first review of the claim through their contacts with the worker and employer to establishing a return to work plan. Included within the protocols are formats for providing a business case when developing vocational rehabilitation plans. Preliminary results suggest the protocols have had a positive impact on the average period of disability days and average claim costs. As well, the Workers' Compensation Board has realized an increased level of client satisfaction due, in part, to the implementation of case management protocols.

2. Standard Setting

Specific expectations for health care service delivery to injured workers are being identified and communicated to the health care community. These standards are being established for each type of health care service and include: clinical practice expectations, accreditations where applicable, set fee schedules, cycle time expectations, length of stay limits, outcome targets, reporting requirements, and business relationship expectations.

3. Authorized Health Care Providers

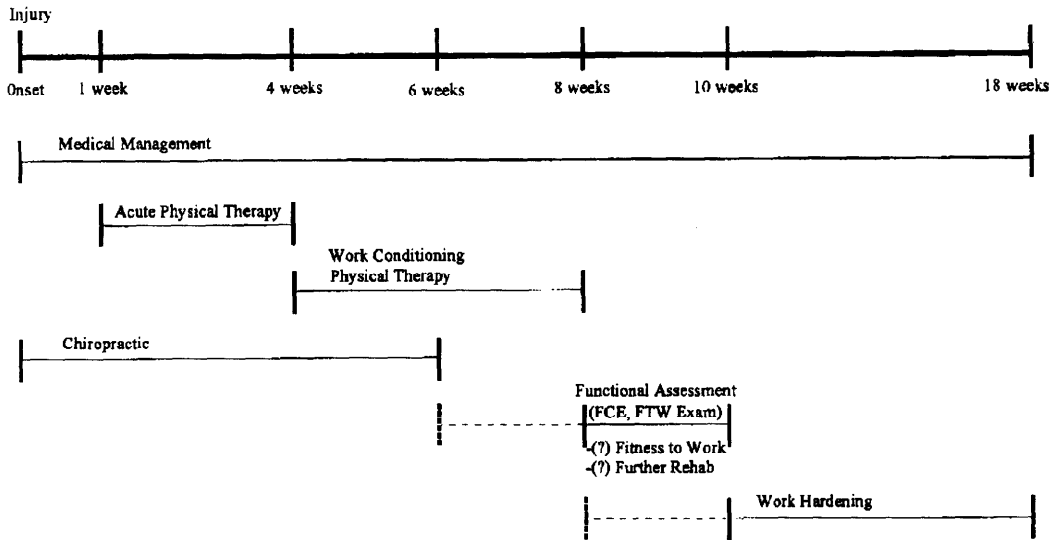
Once the need for a particular type of service has been confirmed and the standards for service provision have been set, the WCB can then secure relationships with health care professionals who provide their services to WCB clientele. The health care professionals identified typically sign a contract or an agreement with the WCB (which stipulates all of the legal, business, and clinical expectations) and in so doing, become authorized providers of that particular service. WCB authorized health care providers make up a comprehensive Providers' Network. This development is particularly important for WCB case managers who can access any member of the Network knowing that they can expect to receive high quality services at a standard price from a professional who has partnered with the WCB in the best interests of both the injured worker and the employer. The Network will be strengthened by members developing interdependencies and relationships as they begin to work together in facilitating an injured worker's rehabilitation. The Authorized Provider Network has also been eagerly anticipated by employers who are increasingly demanding timely and high quality health care services for their injured employees. Recent contact with major employer groups suggests that they are not only supportive of an Authorized Providers' Network, but also that they are interested in working closely with providers within the Network. Finally, injured workers can also expect to benefit from the development of an Authorized Providers' Network in that they will have timely access to high quality health care services.

4. Continuous Improvement/Quality Assurance

The final component of the strategy involves the monitoring of the Network's performance. Specifically, all authorized providers are required to participate in a standardized evaluation of the service or program they provide. This evaluation is undertaken to determine if all service standards are being met and also to

CHART 1

Continuum of Care Soft Tissue Injuries



WCB Workers' Compensation Board Alberta

COPYRIGHT 1995 ALL RIGHTS RESERVED

May 1995

CHCARE/HPC

track outcomes allowing for comparison across different providers. Over time, the results of ongoing evaluation may lead to changes in service standards and/or the makeup of the Network. Internal monitoring will also be done to determine the quality of health care decisions. WCB Health Care Services will undertake comprehensive cost

benefit analyses to determine if timely intervention with high quality health care services actually does result in better outcomes and, hence, overall reduced claims costs. Regular *reports will be generated on all of the above types of evaluation and will be shared with both internal and external stakeholders.

Preliminary cost-benefit analyses indicate the potential for significant savings as well as a reduction in the suffering associated with disability via successful and coordinated implementation of the various components of the Health Care Strategy.

* Manager - Health Care Services, Alberta Workers' Compensation Board, Edmonton

* * *

Glues Can Cause Asthma and Eczema

The health hazards of cyanoacrylates are being assessed. **Johan Montelius**, PhD, the Institute in Solna, has been assigned by the Nordic Expert Group to review the scientific literature on cyanoacrylates' harmful effects on health.

The first cyanoacrylate was introduced commercially in 1958. Cyanoacrylates form strong bonds with many different kinds of materials. Industrial use, therefore, increased rapidly.

The glues were later marketed for household use. Since cyanoacrylate glue can cure on damp surfaces and join skin and mucous membranes, it

has also been used as a surgical glue. All handling of cyanoacrylate glue involves a risk of sticking together fingertips or eyelids. The glued surfaces usually separate spontaneously after a few hours or days and any injuries generally heal with no lasting effects.

The most obvious reactions to cyanoacrylate vapours are irritated

eyes and respiratory passages. These effects provided the basis for present occupational exposure limits. However, it has since become clear that people who use these glues can develop asthma and eczema.

Today there are 12 reported cases of allergic contact eczema suspected to have been caused by cyanoacrylates. In most of these, the glue has been used for attaching false fingernails. That isn't very many cases, considering the number of people who have used cyanoacrylates. However, there is reason to suspect that until now scientists have believed that such cases are less common than they really are.

There are many reports in which symptoms of asthma or other respiratory diseases are associated with inhalation of cyanoacrylate vapours.

In a study made at the Finnish Institute of Occupational Health, it was found that 12 of 880 patients (1.4%) diagnosed as having work-related respiratory diseases had problems caused by cyanoacrylates. Eleven of these patients were women and most of them worked in the electronics industry. In all these cases, the reason for the disease was cyanoacrylate glue. The exposure periods before the symptoms appeared ranged from one week to fourteen years.

Since there are no data on the number of people who have used cyanoacrylates, it is not possible to draw any conclusions on the size of the risk for respiratory problems. Nor is it possible to determine whether the reaction is allergic or due to irritation.

Some cyanoacrylates have been shown to be mutagenic in tests with bacteria (Ames' tests). There are also suspicions that they may be carcinogenic.

[Reprinted from "Research News—Swedish National Institute for Working Life" No. 2 (1996)]

* * *

HIGH PRESSURE INJECTION INJURIES OF THE HAND

Murray Flore, MD*

Introduction

High pressure equipment such as hydraulic lines, airless paint sprayers, high-pressure grease guns, and high-pressure fuel injection apparatus found on diesel and marine engines, has the potential to produce serious injury, or even death, if not used properly.

Fluid in this type of apparatus is under pressure ranging from 600 to 12,000 pounds per square inch. The velocity of fluid forced through such a system, or through a pinpoint break in the line, can be excess of 600 feet per second. This is close to the muzzle velocity of a rifle, and is sufficient to drive fluids through protective clothing such as gloves and coveralls. Penetration has been recorded with distances of up to four inches between the fluid source and skin.

High pressure injection injuries of the hand are a surgical emergency. Unfortunately, because the injection itself is often painless, and the lesion usually has a benign appearance, physicians not familiar with the pathophysiology may treat with expectant observation. This delays definitive treatment (decompression), and may result in a catastrophic outcome. Time between injury and decompression and debridement has been found to be the most important factor affecting outcome.

Most hand injuries to this type occur in men ages 21-59 years. The terminal phalanx of the left index finger is the most commonly injured area. In the majority of cases, the patient has been working at a new job, or has been using a new type of gun. Grease is the most commonly injected substance, followed closely by paint products.

Although there is often little pain at the time of injury, the affected area soon becomes swollen and painful. How quickly this happens depends on the nature of the substance injected. Paints and paint thinners often cause pain and swelling within the first few hours post-injection. Greases, oils and hydraulic fluid may take up to a couple of days before causing pain and swelling.

The amount of damage done and the prognosis for long-term disability depends on:

- *Type of fluid injected.* Paint and paint thinners/solvents cause an early, intense inflammatory reaction. Tissue breakdown is extensive due to the ability of this type of fluid to dissolve fat, thrombose vessels, and cause necrosis of subcutaneous tissue. There is also significant systemic absorption of this type of fluid.

Grease oils, and hydraulic fluid often don't cause any reaction for the first couple of days, but then go on to cause extensive fibrosis, oleogranuloma formation, and draining sinuses.
- *Amount of fluid injection.* The more fluid injected, the less room for vascular structures. This vascular compression leads to ischemia, and finally to gangrene.
- *Pressure of fluid injected.* Fluid pressure is important since it allows the fluid access to the affected area, promotes spread of the injected substance, and determines the amount of fluid injected.
- *Presence of infection.* This may, or may not be a problem. Many of the commonly injected materials are bacteriocidal. However, if infection occurs, it is a further insult to tissue which has already been challenged.
- *Degree of spread of infected material.* This depends in part on the injection pressure, and on the presence or absence of tissue partitions strong enough to stop the flow. If penetration occurs over the membranous segment of a tendon sheath, spread can be the full length of that sheath. If the flexor tendon sheath of the thumb, or little finger happens to be involved, the fluid can spread into the common palmar tendon sheath. Cases have been reported where fluid injected into the hand has been recovered as far away as the elbow.
- *Time between injection and definitive surgery.* This appears to be the most important factor determining the outcome. The sooner that surgery is carried out post-

injection, the less long-term disability will result.

Management

X-rays should always be taken of the affected area. This will often allow determination of the distance of spread from the injection site, and thus how extensive will be the surgical field.

Pre-operative treatment should include:

- Cold compresses and elevation of the limb to decrease the swelling.
- Broad-spectrum antibiotic, preferably parenterally, and tetanus prophylaxis if necessary.

Surgery should be performed under general anesthetic, or brachial plexus block. Ring (digital nerve) block should be avoided because this can contribute further to vascular compression and vasospasm. An Esmarch bandage should never be used for exsanguinations of the limb. Instead a tourniquet should be applied after the arm has been elevated for five minutes.

Operative treatment should include:

- Decompression, followed by debridement, lavage, and scrubbing.

An attempt must be made to remove as much of the injected material, and necrotic tissue as possible. Amputation may be necessary if a digit has been significantly compromised.

- Packing the wound open with material such as iodoform gauze. Drains may be necessary.
- Compression dressing.

Post-operatively the hand should be elevated, and cold packs should be applied in an effort to control further inflammatory edema. Broad-spectrum antibiotics should be continued until signs of infection have resolved. The role of steroids is quite controversial because of the fear of reducing host resistance to infection. After the first 48-72 hours, the compression dressing is changed, usually under general anesthetic. This allows for further debridement, if necessary. The hand is then splinted in a position of function. Skin grafting may become necessary if significant skin necrosis has occurred.

Prognosis

Once healing is complete, the process of rehabilitation can begin. This may

include exercise, Bunnell dynamic-action splints, and compression gloves. About 50% of high pressure injection injuries of the hand result in amputation of a finger. Of the remaining patients, many are left with residual stiffness and loss of function.

Summary

High pressure injection injuries of the hand are becoming more common. This type of injury presents with a very benign appearance, but immediate and aggressive treatment must be undertaken. Damage is done by a combination of distension, and inflammatory edema, causing vascular compromise. The result is ischemia, leading eventually to gangrene and necrosis. Continuing inflammatory reaction can cause fibrosis. Treatment involves decompression, evacuation of injected material and debridement of devitalized tissue. Antibiotics (and possibly steroids) have a role to play.

*Medical Director, Rehabilitation Services Unit, Saskatchewan Government Insurance.

SOUTHERN ALBERTA OCCUPATIONAL MEDICINE PAGE

<http://mir.med.ucalgary.ca/oemweb/>

This website provides a variety of learning resources in occupational medicine to assist undergraduate students, medical residents, and practicing physicians in Alberta.

developed by

**The Department of Community
Health Sciences**

The BACS Learning Centre

**Faculty of Medicine
The University of Calgary**

*with the support of a Medical
Education Grant from*

**The Workers' Compensation
Board Alberta**

TABLE OF CONTENTS

- **Meetings and Conferences**
regional, national, and international meetings and scientific conferences
- **Educational Programs**
training and certification opportunities in occupational medicine
- **Professional Associations**
other medical and non-medical occupational health associations
- **Alberta Occupational Medicine Newsletter**
current issues and publication information
- **Occupational Health and Safety, Alberta Labour**
publications, contact numbers, physician's responsibilities

- **Bacs Learning Centre**
other learning resources for U. of C. medical students and residents
- **The Workers' Compensation Board Alberta**
current affairs, guidelines, and completion of medical reports
- **Articles and References Library**
past newsletter articles, governmental documents, and other key references
- **Other Websites**
a selection of links to other websites of educational interest
- **Research and Epidemiology**
questionnaires and links to research resources

Have a browse and send your comments to:

blaikie@mir.med.ucalgary.ca

UPCOMING CONFERENCES

CANADA:

Occupational Medicine: A Hands-on Approach

Annual Scientific Conference - Occupational and Environmental Medical Association of Canada

September 24 -27, 1997
Vancouver, British Columbia

Contact:

Dr. Ruth McIlrath
Phone: 604-669-8188
Fax: 604-669-8199
e-mail: mcilrath@istar.ca

International Conference on Integrating Health Research In Forest Communities: Occupational Epidemiology, Population Well-being and Sustainability

The Department of Health Care and Epidemiology and the Occupational Hygiene Programme, University of British Columbia

June 4 - 6, 1998
Vancouver, British Columbia

Contact:

Helen Heacock
Conference Director
Phone: (604) 822-2772
Fax: (604) 822-4992
e-mail: heacock@unixg.ubc.ca

INTERNATIONAL:

Plant Safety in the Chemical Industry

June 9-11, 1997
ISSA Chemistry Section
Frankfurt/Main, Germany

Contact:

Secretariat of the ISSA Chemistry Section
C/O BG Chemie, Kurfursten-Anlage 62
D-69115 Heidelberg, Germany
Phone: 49-6221-523498
Fax: 49-6221-523420

Electricity - Safety and Progress

12th International Colloquium of the ISSA Electricity Section

June 18 - 20, 1997
Dublin, Ireland

Contact:

Secretariat of the ISSA Electricity Section
c/o Berufsgenossenschaft der
Feinmechanik und Elektrotechnik
Gustav-Heinemann Ufer 130
D - 50968 Koln
Phone: +49/221/37 78 115/ 448
Fax: +49/221/ 37 78 134/ 457

Epidemiology and Occupational Risks

International Conference on the role and importance of epidemiological studies in the prevention of and compensation for occupational accidents and diseases.

April 22 - 24 1998
Graz, Austria

Contact:

Allgemeine Unfallversicherungsanstalt
Office for International Relations and Conferences
Adalbert-Stifter-Strasse 65, A-1200 Vienna
Phone: +43-1-33 111 - 537
fax +43-1-33 111 469
e-mail: presse@auva.or.at