Section II. Patient Management

Growing concern about the proper treatment of chemically contaminated patients has outpaced adequate guidance on the subject. However, definitive work has been done on cases that bear similar characteristics (e.g., radioactive exposure), and many of the same principles apply. Many of these principles can be found in the article "Emergency Department Radiation Accident Protocol" by R.B. Leonard, Ph.D., M.D., and R.C. Ricks, Ph.D., published in the September 1980 issue of Annals of Emergency Medicine. Further information on radiation response procedures is contained in Hospital Emergency Department Management of Radiation Accidents by Robert C. Ricks, Ph.D., prepared for the Federal Emergency Management Agency.

When a hospital receives a call that a patient exposed to hazardous materials is to be received, *a planned course of action* should be implemented. Steps in a protocol must be practiced before a hazardous materials emergency occurs. All staff members of an emergency department should know their responsibilities and how to perform them. All required equipment should be immediately available or readily accessed.

Individuals receiving a potential hazardous materials call should obtain as much information as possible. A checklist should be developed and made available for all telephone or radio communication centers. Information that will aid in initiating appropriate actions includes:

- Type and nature of incident
- Caller's telephone number
- Number of patients
- Signs/symptoms being experienced by the patients
- Nature of injuries
- Name of chemical(s) involved
- Extent of patient decontamination in the field
- Estimated time of arrival

After the above information is received, a predesignated resource center (e.g., regional poison control center, ATSDR) should be contacted for information regarding definitive care procedures, which should include decontamination methods that need to be performed. Communications should be kept open with on-site response personnel to obtain as much advance information as possible.

If incident notification comes from other than usual emergency communication channels, the call should be verified before a hazardous materials response plan is initiated. Ambulance personnel should be notified of any special approach or entrance to the emergency department and also advised not to bring the patient into the emergency department until the patient has been assessed and accepted by the emergency department.

Often patients contaminated by hazardous materials may be brought into the emergency department unannounced or not through regular EMS channels. This could be an ambulatory patient or a patient transported by private vehicle. The ideal response to this is to call a fire department which is properly trained and equipped or a hazmat team to come to the hospital and set up a decontamination area outside the ambulance entrance. In any event, these patients should be isolated from other patients and assessed and decontaminated as soon as possible.

Emergency Department Preparation

Every member of the emergency department should be familiar with the hospital's hazardous materials response plan and be required to participate in scheduled drills. Preparation for arrival of a contaminated patient should include: notification of all services involved, preparation of a Decontamination Area, and suiting up of the Decontamination Team.

Emergency Department Mobilization

The person receiving a call of incoming victims should notify the Nursing Supervisor who will in turn notify appropriate personnel according to the hospital's response plan. The hospital operator should be instructed to notify security and maintenance, and the nurse on duty should contact the predesignated resource center.

Decontamination Area Preparation

Any victim of a hazardous materials incident must be considered to be contaminated until demonstrated otherwise. Therefore, the route from the emergency entrance to the decontamination area may also become contaminated and all persons along that route should be removed by security personnel. Ideally, this area should be protected with plastic or paper sheeting. This barrier should be taped securely to the floor, and care should be taken while walking on it because plastic can be very slippery when wet.

Security personnel should be stationed at the main entrance of the emergency department close to the decontamination area to prevent unauthorized entry, to control the entrance of the contaminated

patient into the department, and to direct the vehicle transporting the patient to the appropriate area. A reception area should be set up just outside the emergency department entrance, where arriving contaminated patients can be screened for adequate decontamination before entering the department.

A decontamination area should be large enough to facilitate decontamination of more than one patient and accommodate the many personnel involved in patient treatment and contamination reduction. The ventilation system should either be separate from the rest of the hospital or turned off in order to prevent spread of airborne contaminants throughout the facility. If the ventilation system is shut off during the handling of a contaminated victim in an enclosed area, the emergency department medical team could be endangered. Therefore, OSHA regulations (i.e., 29 CFR 1910.120(q)(3)(iv) on monitoring the atmosphere should be adhered to, especially if APRs are used. The best place (weather permitting) to evaluate and initially treat contaminated patients is outside where ambient ventilation will keep cross-exposure low. Some hospitals have radiation decontamination facilities that can be used with minor changes. An outside or portable decontamination system is a viable substitute and would aid in preventing contamination of the emergency department and other patients. A practical alternative for facilities with limited resources is to have a warm shower nozzle, soap, a wading pool, and plastic garbage bags in a predesignated area outside the emergency department back door. The patient may be able to remove his or her own contaminated clothing, place it in a double bag, and do his or her own soap and water decontamination. A partial tent or curtain can provide privacy for the patients. In most circumstances, ordinary hospital gowns, plastic goggles, and plain latex gloves will adequately protect hospital staff in case they have to assist the patient in removing soaked clothing, wash exposed skin and hair, or perform eye irrigation. With large amounts of concentrated corrosives or very oily materials, such as pesticides, disposable CPC and unmilled nitrile gloves will offer additional protection. If it is anticipated that your facility is likely to receive heavily contaminated patients who have not received prior decontamination, then it may be appropriate to purchase appropriate protective gear and to fit and train emergency department staff in its use. However, no person should wear and use specialized PPE, especially respiratory protective gear, without prior training.

To prevent unnecessary contamination, all nonessential and nondisposable equipment should be removed from the decontamination area. All door knobs, cabinet handles, light switches, and other areas that have contact with hands should be taped, and the floors should be covered with plastic or paper sheeting to prevent contamination. The floor coverings should be securely taped to prevent slippage, and the entrance to the room marked with a wide strip of colored tape to indicate a contaminated area. Personnel should not enter the area unless properly protected, and no personnel or equipment should leave the area until properly decontaminated. A "clean" member of the staff should stand on the clean side of the entrance to hand in supplies and receive medical specimens. The essential requirements for any decontamination task are:

- A safe area to place a patient while undergoing decontamination
- A method for washing contaminants off a patient
- A means of containing the rinsate
- Adequate protection for personnel handling the patient
- Disposable or cleanable medical equipment to treat the patient

Decontamination Team Preparation

A decontamination team should be predesignated and trained in appropriate personal protection equipment and procedures. The team should consist of:

- Emergency physician
- Emergency department nurses and aides
- Support personnel
  - — Nursing Supervisor
    - — Occupational Health and Safety Officer
    - — Security
    - — Maintenance
    - — Recorder

The decontamination team should be equipped with personal protective clothing (as discussed in Section I) for whatever level described as appropriate for the substance(s) involved. This may be determined by consulting reference guidebooks, database networks, or telephone hotlines.

Appropriate dress for the decontamination team should include:

- A scrub suit
- Plastic shoe covers
- Disposable CPC with hood and booties built in; tape hood at neck
- Poly Vinyl Chloride (PVC) gloves taped to sleeves
- Respiratory protection as appropriate (see Section I)
- Multiple layers of surgical gloves, neoprene or disposable nitrile gloves; change whenever torn; tape bottom layer
- Protective eyewear

A 2-inch-wide piece of masking tape with the team member's name placed on the back of the protective suits will often assist employee in communicating.

Patient Arrival

The emergency physician-in-charge or an emergency department nurse should meet the ambulance upon arrival and assess the condition of the patients as well as the degree of contamination. Personnel should keep in mind that the actual contamination may be (or become) a life-threatening condition. Triage procedures should also be initiated at this point, if necessary. During initial patient survey and stabilization, contamination reduction should simultaneously be performed. This consists of cutting away or otherwise removing all suspected contaminated clothing, including jewelry and watches, and brushing or wiping off any contamination. Care should be taken to protect any open wounds from contamination. Emergency department personnel should make every effort to avoid contact with any potentially hazardous substance.

Ideally, decontamination should be performed before patient transport; however, field decontamination facilities are limited and emergency department personnel should consider that all hazardous materials patients need decontamination. If a patient's clothing was not removed at the incident site, it should be removed outside the ambulance but before entry into the emergency department. This will reduce further exposure to the patient and lessen the extent of contamination introduced to the emergency department. Contaminated clothing should be double bagged in plastic bags, sealed, and labeled. The decontamination team should bring the prepared stretcher to the ambulance, transfer the patient, and take him or her directly to the decontamination area along the predesignated route.

Priority should be given to the ABC (Airway, Breathing, and Circulation) and simultaneous contamination reduction. Once life-threatening matters have been addressed, emergency department personnel can then direct attention to thorough decontamination and secondary patient assessment. Identification of hazardous materials involved can be simultaneously performed by other personnel. It is important to remember that appropriate personal protective clothing must be worn until personnel are no longer in danger. Therefore, the sooner the patient becomes decontaminated the sooner personnel may reduce protective measures.

Effective decontamination consists of making the patient As Clean As Possible (ACAP). This means that the contamination has been reduced to a level that is no longer a threat to the patient or the responder. The recorder notes on a diagram of the body the areas found by the physician to be contaminated.

Decontamination of Patient

The basic purpose of decontamination is to reduce external contamination, contain the contamination present, and prevent the further spread of potentially dangerous substances. In other words, remove what you can and contain what you can't. With a few exceptions, intact skin is more resistant to hazardous materials than injured flesh, mucous membranes, or eyes. Therefore, decontamination should begin at the head of the patient and proceed downward with initial attention to contaminated eyes and open wounds. Once wounds have been cleaned, care should be exercised so that the wounds are not recontaminated. This can be aided by covering the wounds with a waterproof dressing. For some chemicals, such as strong alkali, it may be necessary to flush exposed skin and eyes with water or normal saline for an extended period of time.

External decontamination should be performed using the least aggressive layer methods. Mechanical or chemical irritation to the skin should be limited to prevent damage to the epidermal layer, which would result in increased permeability. Contaminated areas should be gently washed under a spray of water, with a sponge and a mild soap. Warm, never hot, tap water should be used. Care should be taken so that contaminants are not introduced into open wounds. All run-off from decontamination procedures should be collected for proper disposal.

The first priority in the process of decontamination should be contaminated open wounds. These areas allow for rapid absorption of hazardous materials. Wounds should be irrigated with copious amounts of normal saline, and deep debridement and excision should be performed only when particles or pieces of material have been embedded in the tissues. Decontamination of eyes should also have high priority. Gentle irrigation of the eyes should be performed with the stream of normal saline diverted away from the medial canthus so that it does not force material into the lacrimal duct. Contaminated nares and ear canals should also be gently irrigated with frequent suction to prevent any material being forced deeper into those cavities. Washing with soap and tepid water is usually all that is needed to remove contamination. Hot water, stiff brushes, or vigorous scrubbing should never be used because they cause vasodilation and abrasion. This increases the chances for absorption of hazardous materials through the skin.

Considerations for Patient Treatment

Primary goals for emergency department personnel in handling a contaminated patient include termination of exposure to the patient, patient stabilization, and patient treatment -- while not jeopardizing the safety of emergency department personnel. Termination of exposure can best be accomplished by removing the patient from the area of exposure and by removing contaminants from

the patient. Basically, a contaminated patient is like any other and may be treated as such except that staff must protect themselves and others from dangers due to contamination.

Personnel must first address life-threatening issues and then decontamination and supportive measures. Priority should be given to the ABC with simultaneous contamination reduction. Once life-threatening matters have been addressed, emergency department personnel can then direct attention to thorough decontamination, secondary patient assessment, and identification of materials involved. It is important to remember that appropriate personal protective clothing must be worn until personnel are no longer in danger. Therefore, the sooner the patient becomes decontaminated the sooner personnel may reduce protective measures or downgrade the level of protection. Primary and secondary surveys should be completed as conditions allow. In treating patients, personnel should consider the chemical-specific information received from the hazardous materials response resources. In multiple patient situations, proper triage procedures should be implemented. Presenting signs and symptoms should be treated as appropriate and when conditions allow. The sooner a patient has been decontaminated the sooner he or she can be treated like a "normal" patient. Orders of the designated poison control center and attending physician should be administered. Invasive procedures, such as IVs or intubation, should be performed only for life-threatening conditions, until decontamination is performed. These procedures may create a direct route for introducing the hazardous material into the patient. The patient should be frequently re-assessed because many hazardous materials have latent physiological effects.

Information on Materials Involved

Identification of materials involved should also be determined early in a hazardous material incident. Using resources outlined in this section, and in Section I under Hazard Recognition, personnel should identify and obtain detailed information involving treatment, decontamination procedures, and possible adverse health effects of the specific chemical(s) involved. Information that may be needed will include:

- Chemical name of substance involved
- Form of material (solid, liquid, gas)
- Length of exposure
- Routes of exposure
- Possible adverse health effects
- Treatment/antidote therapy
- PPE required
- Decontamination procedures

The importance of finding out as much as possible, as soon as possible, about an unknown substance cannot be emphasized enough; however, based on experience, NIOSH and EPA recommend that "Level B" protection is the minimum level to be worn when entering an area containing unknown substances. However, if the substance in question is suspected to involve the skin as a route of exposure or is otherwise

noted to be dangerous by absorption, corrosion, and the like, "Level A" protection should be worn because it provides additional skin protection.

Removal of Patient from Decontamination Room

After the patient has been decontaminated, he or she should be discharged home or admitted to the hospital, depending on the patient's clinical condition. Place a clean piece of plastic on the floor for the patient and staff to use when exiting the clean area. If the patient is not ambulatory a clean stretcher or wheelchair should be brought to the doorway by an individual who has not been exposed. After the patient is transferred to the clean area, the physician can perform the physical examination and initiate routine patient management.

Note: The attending staff must remember that since exposure to some substances can result in serious delayed effects, sustained observation and monitoring are required.

Critique

As soon as possible after each incident, all participating units should send knowledgeable representatives to review the measures that were taken by each unit or agency. The purpose of this review is to examine which activities succeeded and which did not, and to evaluate the overall coordination effort.

Patient Management Under Mass Casualty Conditions Involving Hazardous Chemicals

Basic medical procedures in a large-scale hazardous materials incident are not substantially different from life-saving measures in other mass casualty disasters. Primary attention to the ABC continues to have first priority with decontamination performed at the same time. A chemical disaster may overwhelm any one hospital, particularly if it occurs along with another disaster such as an earthquake. Hospitals need to preplan what they will do if they are overwhelmed with hazmat patients.

There are, however, several important differences in disasters involving hazardous materials. Such differences include the need for the effective decontamination of exposed patients and response personnel, and the need for effective safety measures to protect response personnel. Training in the appropriate procedures to be followed is essential for potential responders to a hazardous materials incident involving mass casualties. Standard principles of triage apply in chemical disasters, except in exposures to very toxic substances. The patient, injured or not, must be decontaminated before being transported to the emergency department to protect EMS and emergency department staff.

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