A PROCEDURE FOR THE TREATMENT OF GAS CASUALTIES

BY

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The cleansing of gas casualties presents two major problems: first, the treatment of the gas burns on the body surface; secondly, the marking, cleansing, and returning to the rightful owners of all gas-contaminated clothing. From the nature of the physical and pathological processes underlying vesication by blister gases it is at once obvious that excessive elaboration of the second of these two

divided into male and female sides, each side consisting of a stripping-shed, an undressing-room, a shower-room, and a dressing-room, with a common equipment store. The city engineer has kindly permitted us to publish a copy of the plans, from which the general lay-out of the various rooms may be seen ; this may be compared with the plan recommended in the Ministry of Health Circular No. 2241 (December, 1940).

Personnel

Efficiency and smooth running cannot be obtained if the centre is understaffed. In our opinion the minimum number of workers in each room on each side is two. In addition to the two workers in each stripping-shed the superintendent, if male, should be in charge of the outside workers on each side, and should be responsible for the orderly admission of casualties to the centre. If the superintendent is a female then a third responsible male worker must take charge of the sheds. In the

problems will lessen the effectiveness of the treatment applied to the actual burns by reason of the delay necessarily involved. To obtain the most satisfactory results speed is essential, and we must aim at securing a system of marking clothes for subsequent identification which will not unduly delay the starting of treatment. The problem is further complicated by the fact that only a limited amount of protective clothing is available for any one cleansing centre, so that the number of workers is thereby limited.

In view of the special difficulties attendant on the decontamination of gas casualties and the general organization of cleansing centres we feel that it may be of some value to describe a procedure, based on the official recommendations, which has been worked out and tested at a cleansing centre in Oxford. If this description serves only to call forth criticism of the procedure adopted it may direct the attention of the authorities concerned to some practical but none the less important problems.

In conformity with the official regulations the building that has been erected to house the cleansing centre is

shower-room one worker shall be responsible for douching the eyes of all casualties, while the other is in charge of the showers. It would add greatly to the efficiency of the centre to have a third worker in this room to assist with the eye-douching.

Following on the principle of stationing a responsible person in the stripping-shed to be in charge of admissions, we have decided that it is of greatest advantage for the medical officer to limit, if possible, his activities to the shower-room and dressing-room. By so doing he can work without the hindrance of protective clothing, can direct the treatment of any serious eye lesions, and can supervise general first-aid measures in the dressing-room. Of the two workers in each dressing-room one shall be responsible for all clerical work (patient's name, address, nature of injury, etc.); the other will supervise the dressing of casualties and will carry out first aid where required. In addition, one or two workers, depending on circumstances, will be required to take charge of the equipment store and to issue towels and clothing.

Equipment

In order to carry out the procedure of cleansing suggested here the following is the absolute minimum of equipment necessary for efficient treatment of casualties and for safety to personnel:

9 protective suits	6 hand-basins
13 pairs wellington boots	1 drum dry bleach
5 pairs protective gloves	4 containers for bleach (tins or boxes)
5 helmets	10 hurricane lamps
5 hoods	5 electric torches
12 pairs rubber gloves	4 stools
5 rubber aprons	Anti-gas ointment No. 2
6 douche-cans with tubing and nozzles	Sodium bicarbonate
2 bleach trays	Soap
12 buckets	Wooden spatulas
6 bins	First-aid equipment
2 boot-brushes	Towels
4 pairs tailor's shears	Sets of clothing
4 pairs scissors	Civilian respirators

Each member of the centre is expected to have been issued with a C.D. respirator. It will be noted that the suggested equipment exceeds the official issue in several respects.

In training the personnel of a cleansing centre it is helpful to divide their functions into: (a) duties of personnel on arrival at cleansing centre—these duties involving the setting-up of the centre in such a way that treatment may start immediately the casualties begin to arrive; (b) duties of personnel during cleansing procedure. It will be profitable here to consider these two aspects of the work separately.

Duties of Staff on Arrival at Centre

The first member of the staff to arrive must open the centre and lower all air-lock blankets. Such members of the centre as have been trained for work in protective clothing should begin to dress immediately on arrival. The first two of these workers to arrive on each side (that is, male and female) will be expected to put on full protective clothing (suits, wellingtons, protective gloves, gas-masks, helmets, and hoods) and to work in the stripping-shed. The next two to arrive on each side will prepare to work in the undressing-rooms, and will therefore put on suits, wellingtons, gas-masks, and rubber gloves. We are well aware of the fact that thin housemaid's rubber gloves do not provide a high degree of protection against mustard gas or lewisite; on the other hand, it is essential that the undressing-room personnel shall be able to work rapidly and, if the need arises, remove difficult articles of clothing unhampered by full protective gloves. We suggest, therefore, that workers in these rooms shall wear medium-thickness rubber gloves and shall take further precautions to decontaminate the surface of these gloves as described later.

Members trained only for work in shower-rooms and dressing-rooms will be expected to carry out their duties immediately on arrival. *Shower-room attendants*, having put on wellingtons and rubber aprons, must adjust the water-mixing valves and test the temperature of the water issuing from the showers. They must then fill the douche-cans with 1 to 2% sodium bicarbonate solution and hang them on hooks ready for use (nozzles should be opened till rubber tubing is filled; this will also ensure that neither tubing nor nozzles are blocked). They must then thoroughly wet all air-lock blankets. *Dressing-room attendants* must first collect and arrange the equipment in the stripping-sheds and undressing-rooms. On completion of this they will assist the dressing of any workers who have not yet finished putting on protective clothing.

When the above duties have been carried out all workers will go immediately to their posts, where they will check over the equipment and await the arrival of casualties.

Cleansing Procedure

The sequence of cleansing takes place in four stages—stripping-shed, undressing-room, shower-room, and dressing-room. The particular function of each stage in the scheme, which not only allows cleansing of the patient but also provides that he shall regain his washed clothing, is as follows:

STRIPPING-SHED

The two workers wear protective clothing, wellingtons, protective gloves, gas-masks, helmets, and hoods. (The personnel and equipment recommended in this and the following sections apply to one side only—that is, male or female.) Equipment consists of:

- 1 container of dry bleach (to replenish bleach solution)
- Tray with bleach solution and brush (*Note 1*)
- 1 bucket of bleach solution
- 1 bucket of water
- 2 pairs tailor's shears
- 1 jar anti-gas ointment No. 2
- 2 wooden spatulas
- Hurricane lamps and electric torches
- Pile of "bag units" (*Note 2*)

Note 1.—The tray should be filled to a depth of about 1 in. with a thick suspension of bleach in water.

Note 2.—The "bag unit" consists of: (1) *Bag A*—A large numbered sack (21 in. wide, 30 in. deep); (2) *Bag B*—A slightly smaller numbered sack to which is loosely fastened a numbered tally attached to string loop for passing over patient's head. Each of the two bags and the patient's tally are identically numbered. The bags are folded up and fastened together with a single loop of cotton or a paper band so as to be readily separable.

Procedure.—On the arrival of a casualty the worker picks up a bag unit, detaches Bag A and hangs Bag B on a hook placed in the wall about 3½ feet from the ground. The patient is instructed to stand in the tray of bleach solution, to remove the contents of the pockets of his outer clothing, and to place them in Bag B. The worker meanwhile brushes the boots with the bleach solution. All coats, skirts, and hats are now removed from casualties and placed in Bag A; any other clothing obviously contaminated with liquid gas is also to be removed and placed in Bag A. After brushing with bleach solution the boots are removed, laces being cut to speed up the process if necessary. The boots are then dipped in a bucket of water to remove excess bleach, which would otherwise damage clothing, and are then put into Bag A. Bag A is now placed in a bin to await removal to a laundry. If it is desired that each article of clothing sent to the laundry should be numbered, the contents of Bag A can quite simply be numbered individually, using safety-pins, on arrival at the laundry, or at the cleansing centre after all casualties have been treated and sent away. If splashes of gas are observed on exposed skin or hair they are treated with anti-gas ointment No. 2, applied with a wooden spatula (wooden tongue-depressors serve excellently); if obvious erythema of the skin has already developed no ointment is applied. The patient now takes Bag B and passes into the undressing-room.

It is important that the floor of the shed shall be swilled down with bleach solution, from the bucket provided, at the starting of work and at intervals thereafter.

UNDRESSING-ROOM

The two workers wear protective clothing over underclothes (or protective aprons over boiler-suits), gas-masks, wellingtons, and medium-thickness rubber gloves. The equipment is:

- 1 container of dry bleach
- 1 bucket of bleach solution
- 1 bowl of bleach solution and 1 of water
- 2 pairs scissors
- Anti-gas ointment No. 2 and spatulas
- Several changes of rubber gloves
- Latrine buckets
- 3 bins

Procedure.—Each patient is instructed to undress completely as rapidly as possible and to place his clothing in Bag B, which he has brought in with him; for speed it is desirable that the bags should be hung on hooks to facilitate the insertion of clothes. If either of the workers detects any heavily contaminated clothing that has escaped removal outside, this is to be removed from the patient and placed in a bin labelled "Clothes"; this clothing will ultimately be destroyed or, if national policy dictates that no clothes are to be destroyed, numbered pins may be attached to Bag B, one of which would now be fastened to the clothing before placing in the bin. The clothing can then be decontaminated and returned to the owner. Patients are also instructed to remove their gas-masks last, unless they are liquid-contaminated; gas-masks are then placed in a bin labelled "Respirators" for subsequent recovery. Any liquid splashes on the skin or on the hair are to be treated with anti-gas ointment No. 2 if this has not already been done. When the patient is completely undressed the numbered tally is detached from the bag and hung round the neck, and he is then passed through to the shower-room carrying his bag. In view of the limited protection afforded by the rubber gloves worn in

this room workers must be instructed to dip their gloved hand in the bowl of bleach solution provided, followed by rinsing in water, as often as possible—e.g., at five-minute intervals; further, if the gloves become liquid-contaminated they must be changed at once for a fresh pair, after washing the hands in bleach, and the contaminated gloves placed in a bin; they can later be decontaminated by boiling for two hours.

The floor of the undressing-room must be swilled down with bleach solution at the beginning of work and at intervals thereafter.

SHOWER-ROOM

The two workers wear rubber aprons over boiler-suits and wellingtons. The equipment consists of:

- Soap
- 3 douche-cans for eyes, containing 1 to 2% sodium bicarbonate solution
- 2 stools

Procedure.—On entering the room each patient, after being instructed to sit on the stool provided, is to have both eyes well irrigated. He is then instructed to step under a shower, having previously put his bag in some convenient place. When thoroughly wet he steps out from the shower and soaps his entire body; on completion of this he gets under the shower for a final rinse. Particular attention must be paid to wetting and soaping the hair. The patient finally picks up his bag and passes through to the dressing-room. If for any reason patients are unable to wash themselves this will be done by the workers, who will in any case supervise all washing.

DRESSING-ROOM

Each patient is now handed one towel and one set of clothing. Before leaving, his name and address, particulars of any injury, and number on bag are taken down. The neck-tally is given up, and he is issued with a form giving instructions as to the method of decontamination of the contents of Bag B. Ideally the contents of Bag B should be uncontaminated; in practice, however, it is very possible that this will not be the case, and we feel that in the interests of safety the bag and its contents should always be decontaminated. It is suggested that the form be worded as follows:

WARNING

The contents of this bag are dangerous. They must not be taken into the house, and cannot be used with safety until they have been decontaminated as follows:

First empty all pockets and spread the contents, together with any other loose valuables, on the ground in such a way that they are not likely to be blown away or spoiled by rain. Leave for not less than forty-eight hours. Keys and other metal objects may be taken into the house directly and decontaminated by boiling for one hour in plain water.

All clothes and the empty bag should be hung out of doors and left for not less than forty-eight hours; all articles that will stand it should then be boiled for two hours in plain water.

Immediately after handling these articles the hands must be well washed with soap and water.

The empty bag is subsequently to be presented at the distribution centre in exchange for the decontaminated outer clothing.

When the attendant in the dressing-room is satisfied that all these steps have been carried out, the patient is provided with a fresh gas-mask and is allowed to leave the building.

Discussion

In order to prevent vesication after contact of the skin with mustard gas or lewisite it is well known that treatment with soap and water must be begun within ten minutes, and that this interval should be reduced as much as possible if the best results are to be obtained. If contamination of the eyes has occurred early treatment is even more essential.

The decontamination procedure outlined above is an attempt to define and standardize the duties of the various workers at a cleansing centre in such a way that washing with soap and water may be started at the earliest possible time coincident with (a) a system of marking the clothing for subsequent identification and (b) the safety of the personnel of the centre. In the interest of speed, therefore, we have attempted to eliminate so far as is possible the responsibility of any member of the personnel to decide whether contamination of a particular article of clothing or of any part of the body has or has not occurred. It is for this reason that we have adopted the policy of removing all outer clothing in the stripping-shed and of irrigating the eyes of every casualty. At the same time, if, in the course of his duties, a worker happens to detect gross contamination of the skin or hair we have suggested that anti-gas ointment should be applied in case of any subsequent delay in getting under the showers. Anti-gas ointment will also obviously be of use in the accidental contamination of any of the workers. Further, it is in order to accelerate the process of undressing that we have adopted the use of rubber gloves in place of the official protective gloves for the workers in the undressing-rooms.

In view of the difficulty experienced by workers in giving verbal instructions to casualties while wearing respirators we suggest that notices printed in bold type should be exhibited in the stripping-sheds and undressing-rooms, giving concise instructions concerning the more important points of procedure. The notices that we are using are worded as follows:

For the stripping-shed:

READ THIS

1. Do not remove gas-mask.
2. Step into bleach tray.
3. Place contents of pockets in small bag.
4. Remove outer clothing and place in large bag.
5. Remove boots and give to assistant

Act Quickly and Obey Orders.

For the undressing-room:

READ THIS

1. Do not remove gas-mask.
2. Undress quickly and place clothes in bag.
3. When undressed go to assistant.

In the event of a large number of casualties arriving for treatment it would be helpful to exhibit a notice in the dressing-room giving instructions that no one must leave the centre before being issued with a new gas-mask; it will be remembered that these are not issued until the workers are satisfied that all other formalities have been carried out.

One of the greatest difficulties that we have experienced in training several teams of workers is the irrigation of the eyes: if blepharospasm is present it will be almost essential for the medical officer to take charge of the douching. In order to be in any way effective irrigation must be copious, and we are of the opinion, therefore, that three douche-cans should be an absolute minimum in any shower-room; on this basis two cans can be in use at any time, with a third in reserve to be used while the others are being refilled. It should be pointed out that if the employment of sodium bicarbonate solution involves any delay in filling or refilling the douche-cans warm water should be substituted; if douche-cans are unavailable or if any difficulty is experienced in their use by members of the personnel a large teapot will serve excellently and will have the added advantage of greater capacity. It will be noticed that in this procedure irrigation of the eyes is carried out in the shower-room. In spite of the fact that irrigation

should be begun at the earliest possible moment after contamination we are of the opinion that this should not be done by workers in the undressing-room; these workers will be wearing respirators and rubber gloves, and we feel that under these conditions it would be almost impossible to irrigate contaminated eyes effectively, and that an attempt to do so would only cause delay and possibly spread contamination. It might be argued that it is neither necessary nor even advisable to wash the eyes of every patient, and that it would perhaps be an advantage to restrict irrigation to those with obvious contamination of the eyes or who give a history of suspected contamination. All casualties, however, should be instructed to seek medical advice if ocular symptoms develop in the course of the next twenty-four hours.

The treatment of liquid-contaminated hair presents a difficult problem. Undoubtedly the most satisfactory method would be to cut off the affected hair; such a practice, however, particularly in the case of women casualties, might be strenuously opposed, so that a considerable delay might occur while persuading the casualty to allow the hair to be cut. It is for this reason that we have proposed the application of anti-gas ointment to the contaminated patch, while at the same time issuing instructions to the personnel to cut off the hair if this can be done quickly and with the consent of the patient.

We have not attempted to discuss here the difficult question of the cleansing of those who are also wounded. With a personnel trained in first aid most minor cases could almost certainly be taken by following this procedure. Stretcher cases obviously present special problems, though in a sense the treatment is simplified, since in these cases the marking of all clothing for subsequent identification is of very secondary importance.

Conclusion

We would like to point out that we are presenting an account of the above procedure solely because of the lack of detailed guidance that has been offered with respect to the many difficult problems arising during the working of a public cleansing centre. The only claim that we make regarding the procedure is that it has been tested at many practice exercises, and the cleansing of unwounded patients has been carried out with, we feel, the minimum of delay.

We would like to thank Dr. G. C. Williams, the medical officer of health, and the staff of the public health department of the City of Oxford for the help they have unfailingly given us in the organization of this cleansing centre; and also the personnel of the centre for their ready attendance at many practice exercises. Our thanks are also due to Dr. R. B. Fisher for many helpful suggestions.

GALLANTRY IN CIVIL DEFENCE

In a *Supplement* to the *London Gazette* dated September 12 the award of the M.B.E. (Civil Division) to Dr. JOHN JOSEPH MCCARTHY, medical officer, mobile unit, Islington, is announced. The announcement reads as follows: "Bombs demolished houses, gas and water mains were fractured, and people were trapped in the wreckage. Dr. McCarthy worked with the rescue party and repeatedly entered a gas-laden tunnel to attend to casualties and administer oxygen to a trapped man."

The name of Dr. GRACE ELIZABETH MCCONKEY, medical officer in charge, first-aid post, Liverpool, has been brought to notice for brave conduct in civil defence.

The names of Dr. GEOFFREY GORHAM HOLMES, medical officer, mobile first-aid unit, Bishop's Stortford, and Dr. GAVIN HAMILTON LIVINGSTONE, surgeon, Oxford, have been brought to notice for brave conduct when aircraft crashed and caught fire.

STATE OF PUBLIC SHELTERS IN LARGE CITIES

SUMMARY OF RESULTS OF SPECIAL INVESTIGATION

The shelter situation in London, in particular the improvements which have been effected since last winter, was the subject of an article in the last issue (p. 414). Below are summarized the results of an investigation on behalf of the *British Medical Journal* which has extended to seven principal cities of Great Britain. Once again we have to acknowledge the very great courtesy and help afforded by the officials of the various authorities concerned and by representatives of voluntary agencies. All the information set down has been obtained at first hand by personal visits to different types of shelters in the various towns.

In the large cities of Great Britain the shelter problem is much the same as in London, except that when raiding occurs it is likely to be more concentrated and therefore more devastating in its immediate effects upon the community and the public services, so that a larger proportion of the population seek shelter. In Liverpool, for example, it is estimated that 75% go to shelter every night, and 95% if there is an "alert." Another feature of badly raided cities which does not present itself in London is the nightly trek out of the city into the country. Outlying parish halls and such places have been sometimes opened up for these refugees, but many sleep in buses, others go to barns and other farm buildings, and not a few sleep in hedges and fields, with deleterious results to health.

The Position in Bristol

Bristol has 1,150 shelters, including communal and surface, but not Andersons. The city is divided into five sections for A.R.P. purposes, each division with its own organization, which is co-ordinated by central control. There are eleven medical aid posts, with nurses in attendance and doctors at call. Doctors must, however, be summoned by a responsible official, but in addition they visit shelters for routine health inspection. There are first-aid points in every dormitory shelter, which can be opened by nurse or doctor. One or two dormitory shelters have their own canteen, but the authorities discourage the making of shelters into "clubs." Dormitory shelters are sprayed and cleaned out every day. Very little infestation has been noted. The number of children who go regularly to the shelters—about 1,200 even in the middle of summer—gives rise to some disquiet.

One of the Bristol shelters is a tunnel, in which thousands of people congregated under very bad conditions at the beginning of last winter. The tunnel has now been lined with corrugated iron and turned into quite a good shelter, with a first-class medical aid post, built by the shelter marshal, a former Navy man. Nurses with V.A.D. training visit during the day the homes of the frequenters of small shelters. Bristol insists on bedding being removed from shelters every day.

Some very good concrete surface shelters were found in Bristol, but they were unused, although superior to some basements for which the public showed a preference. Some of the basement shelters seemed cold and gloomy. One, however, under a factory was well aired and warm. Cura stoves are being fitted in the trench shelters.

Shelters at Cardiff

There are groups of ten to twenty shelters, each shelter being something over 30 ft. long, with roofs, walls, and floors of solid monolithic construction, and with a layer of concrete skin on the foundations, the value of which is stated to be that should a bomb fall in the vicinity, while the building might "bounce," it would immediately return to its original position. Each of the two hundred or so buildings is to contain 48 bunks in two tiers, with reasonable space between each, and a plywood screen at the bunk head to prevent droplet infection. The sanitary