

Communicable Disease Report

The infection hazards of human cadavers

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Summary

Cadavers may pose infection hazards to people who handle them. None of the organisms that caused mass death in the past – for example, plague, cholera, typhoid, tuberculosis, anthrax, smallpox – is likely to survive long in buried human remains. Items such as mould spores or lead dust are much greater risks to those involved in exhumations. Infectious conditions and pathogens in the recently deceased that present particular risks include tuberculosis, group A streptococcal infection, gastrointestinal organisms, the agents that cause transmissible spongiform encephalopathies (such as Creutzfeldt-Jakob disease), hepatitis B and C viruses, HIV, and possibly meningitis and septicaemia (especially meningococcal). The use of appropriate protective clothing and the observance of *Control of Substances Hazardous to Health* regulations, will protect all who handle cadavers against infectious hazards.

Introduction

Most people rarely, if ever, encounter a dead body and, for the majority, living people with diseases are a far greater hazard to health than the dead. There are a few whose occupational contact with cadavers exposes them to the hazard of infection. Archaeologists or construction workers may be exposed to the remains of people who died long ago. Others are exposed to the recently deceased, either in a controlled setting, such as a mortuary, or where bodies may be damaged and tissues scattered, such as at the scene of an accident. Medical practitioners (in particular, pathologists), nurses, mortuary attendants, forensic scientists, embalmers, funeral directors, and members of the emergency services handle whole corpses. Others, such as technicians in morbid anatomy, may only handle parts of cadavers. All of these are potentially at risk of exposure to pathogenic microorganisms carried by the cadavers with which they come in contact. This paper describes and assesses the infection hazards associated with cadavers (both in old interments and the recently deceased), indicates how they may be minimised, and aims to inform those with statutory responsibilities for the disposal of the dead. Some of the topics (body bags, universal precautions, viewing, hygienic preparation, embalming, and international transport of cadavers) are discussed in greater detail in an accompanying article¹.

Notifiable and other diseases

In the United Kingdom, five diseases (cholera, plague, relapsing fever, smallpox, and typhus) and food poisoning are statutorily notifiable under the *Public Health (Control of Diseases) Act, 1984*² and a further 24 are required to be notified under the 1988 regulations³. Most of these diseases do not cause serious or life threatening illness in healthy people; their notification is to enable action to be taken to control outbreaks, monitor the effectiveness of immunisation programmes, or facilitate epidemiological investigations. The diseases required to be notified are listed in table 1, with an indication of the risk that these diseases pose to healthy people, and the precautions to be taken when dealing with cadavers known to be infected with these diseases. Table 2 provides similar information about a number of diseases that are not notifiable.

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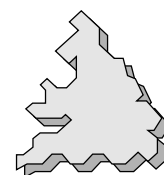


Table 1 Guidelines for handling cadavers with infections notifiable in England and Wales

Degree of risk	Infection	Bagging	Viewing	Embalming	Hygienic preparation
Low	Acute encephalitis	No	Yes	Yes	Yes
	Leprosy	No	Yes	Yes	Yes
	Measles	No	Yes	Yes	Yes
	Meningitis (except meningococcal)	No	Yes	Yes	Yes
	Mumps	No	Yes	Yes	Yes
	Ophthalmia neonatorum	No	Yes	Yes	Yes
	Rubella	No	Yes	Yes	Yes
	Tetanus	No	Yes	Yes	Yes
Medium	Whooping cough	No	Yes	Yes	Yes
	Relapsing fever	Adv	Yes	Yes	Yes
	Food poisoning	No/Adv	Yes	Yes	Yes
	Hepatitis A	No	Yes	Yes	Yes
	Acute poliomyelitis	No	Yes	Yes *	Yes
	Diphtheria	Adv	Yes	Yes	Yes
	Dysentery	Adv	Yes	Yes	Yes
	Leptospirosis (Weil's disease)	No	Yes	Yes	Yes
	Malaria	No	Yes	Yes *	Yes
	Meningococcal septicaemia (with or without meningitis)	Adv	Yes	Yes	Yes
	Paratyphoid fever	Adv	Yes	Yes	Yes
	Cholera	No	Yes	Yes *	Yes
	Scarlet fever	Adv	Yes	Yes	Yes
	Tuberculosis	Adv	Yes	Yes	Yes
	Typhoid fever	Adv	Yes	Yes	Yes
	Typhus	Adv	No	No	No
	High	Hepatitis B,C, and non-A non-B	Yes	Yes	No
High (rare)	Anthrax	Adv	No	No	No
	Plague	Yes	No	No	No
	Rabies	Yes	No	No	No
	Smallpox	Yes	No	No	No
	Viral haemorrhagic fever	Yes	No	No	No
	Yellow fever	Yes	No	No	No

Adv = Advisable and may be required by local health regulations. *Requires particular care during embalming.

Definitions:

Bagging: placing the body in a plastic body bag.

Viewing: allowing the bereaved to see, touch, and spend time with the body before disposal.

Embalming: injecting chemical preservatives into the body to slow the process of decay. Cosmetic work may be included.

Hygienic preparation: cleaning and tidying the body so it presents a suitable appearance for viewing (an alternative to embalming).

Old interments

The disposal of relatively small numbers of bodies in rural settings posed little problem in the past. As urban populations grew in the eighteenth and nineteenth centuries, increasing numbers of burials presented health hazards. A movement dedicated to ensuring that burial should only take place outside cities arose in Europe during the eighteenth century⁴, but had little impact in Britain. By the 1840s over 50 000 corpses were interred in London each year in only 218 acres of burial grounds. Coffins were often stacked several deep, with little earth cover, and a foul stench frequently emanated from churchyards. The problem was similar in other towns and cities. Crypts and burial grounds had to be cleared out frequently and remains reinterred in charnel pits (see below). Archaeological excavations or building work in the older parts of towns in

Britain are quite likely to uncover human remains. As the nineteenth century progressed burial grounds were moved increasingly to the borders of urban areas. Crematoriums have been built in the British Isles since the end of the nineteenth century. Cremation has become increasingly popular and about 70% of cadavers in the United Kingdom are now cremated.

Occasionally, large collections of human bones are discovered, which may be the remains of an overcrowded churchyard, plague pit, or charnel pit. When epidemics occurred, whether in town or country, it was often impossible to bury all the dead in individual graves and the authorities tended to resort to mass burials (plague pits). The locations of larger pits are often indicated in parish records but small unrecorded pits are sometimes found. In plague pits the remains tend to be found in the

form of the human skeleton unless they have been disturbed by previous building activities or land movements. Bones found in charnel pits are either in a random array or may be arranged as – for example – collections of skulls or long bones. Plague pits present no hazards, because bodies were usually interred without coffins. The organisms that caused mass deaths in the past do not survive well outside living hosts and are unlikely to withstand the intense microbial competition that occurs in decay. Charnel pits too are not hazardous because the disarticulated bones they contain have already been exposed to decay.

In many instances when old interments are disturbed, the dead are found in coffins. Old coffins in good condition should be removed intact and reburied, but they are often fragile and should be sleeved in very heavy duty sealed plastic before being moved. Wooden coffins have been used for many centuries, but lead coffins with or without wooden covers or linings and with varying amounts of furnishing and upholstery became popular during the eighteenth and nineteenth centuries.

Rarely it may be necessary to open coffins, or they may have been broken open by building works, soil pressure due to subsidence, or vandals. The degree of preservation of a cadaver cannot be predicted by the type of coffin used or the location of the interment. Completely preserved bodies have been found in wooden coffins buried in the ground and completely decayed bodies in apparently intact lead coffins in crypts. Most lead coffins contain dry bones but some are found to be about one third full of a viscous black liquid (coffin liquor), which contains bones and (sometimes) soft tissues. Well preserved, partially mummified bodies are sometimes found and, very rarely, intact and totally preserved bodies are found that are not even discoloured. Regardless of the age of a burial residual soft tissue is a potential hazard and, if present, expert medical advice should be obtained from the local consultant

in communicable disease control (CCDC). This is particularly important with well preserved or mummified bodies and even more so if skin lesions are seen.

Detailed regulations cover the exhumation of human remains⁵. A Home Office licence is required for the disturbance of human remains and, if they are accidentally disturbed, work should be stopped and the Home Office informed. If remains are to be disturbed in a consecrated burial ground or a church crypt, a faculty must be obtained from the local bishop before exhumation can proceed. The local environmental health department (EHD) must always be informed as it has statutory responsibility for the decent and safe disposal of the dead. The EHD will supervise the exhumation on behalf of the Home Office and the church (if involved), should inspect the exhumation site at intervals to ensure that the work is being performed in a decent and decorous manner, and should alert their medical authorities if necessary. Exhumed remains, timbers, and other burial materials should be reburied. Cremation is unsuitable because old remains have a low fat content and require higher temperatures for longer periods than recently deceased bodies, which can damage or destroy the cremator.

Chloride of lime should not be used as a disinfectant during exhumations. It is not particularly effective and is hazardous to the workforce.

Pathogens that may be associated with old burials

Most deaths in the United Kingdom are now due to non-infectious causes – for example, cancer and cardiovascular disease – but many of those interred in graves in previous centuries may have died from infectious diseases such as plague, cholera, typhoid, tuberculosis, anthrax, and smallpox. The organisms that cause the first four of these diseases are unlikely to survive long in a buried cadaver, even in mass burials such as plague pits, and do not

Table 2 Guidelines for handling cadavers with some infections that are not notifiable in England and Wales

Degree of risk	Infection	Bagging	Viewing	Embalming	Hygienic preparation
Low	Chickenpox/shingles	No	Yes	Yes	Yes
	Cryptosporidiosis	No	Yes	Yes	Yes
	Dermatophytosis	No	Yes	Yes	Yes
	Legionellosis	No	Yes	Yes	Yes
	Lyme disease	No	Yes	Yes	Yes
	Orf	No	Yes	Yes	Yes
	Psittacosis	No	Yes	Yes	Yes
	Methicillin resistant <i>Staphylococcus aureus</i>	No	Yes	Yes	Yes
	Tetanus	No	Yes	Yes	Yes
Medium	HIV/AIDS	Adv	Yes	No	No
	Haemorrhagic fever with renal syndrome	No	Yes	Yes	Yes
	Q fever	No	Yes	Yes	Yes
High	Transmissible spongiform encephalopathies (for example, Creutzfeldt-Jakob disease)	Yes	No *	No	No
	Invasive group A streptococcal infection	Yes	No	No	No

Adv = Advisable and may be required by local health regulations.

* If necropsy has been carried out.

Definitions: see table 1.

present a hazard. The risks posed by anthrax and smallpox are less clear.

Anthrax is a potential risk because it can form highly resistant spores. These are affected by moisture, temperature, and pH⁶ but can last for long periods in dry conditions. Spore formation occurs only under aerobic conditions and extensive spores could only be formed in association with a human cadaver if blood containing the organism had been spilt at the time of death. Large numbers of spores are therefore unlikely to be found in bodies in old burial sites. In addition, anthrax has been an uncommon cause of death in Britain for 200 years (although there may be foci of anthrax spores where animal products were handled commercially) and infected corpses are unlikely to be found. Humans are moderately resistant to anthrax⁶ and unlikely to be infected even if in contact with an infected cadaver.

Britain has been largely free of smallpox since 1935⁷ (a few sporadic cases occurred after this date). Relatively recent graves may therefore contain the remains of people who died of this disease. The risk that smallpox might re-emerge if the remains of smallpox victims are disturbed appears to be remote. The virus is thought unlikely to survive in scabs in interments for more than a year⁸, although it may persist for longer under certain conditions^{8,9} and smallpox virus in scabs has been shown to survive for at least 13 years in envelopes in a laboratory cupboard¹⁰. Morphologically intact orthopox virus was seen by electron microscopy of tissue from bodies more than 100 years old found in a crypt in Spitalfields, East London in 1985, but the virus could not be grown and was not thought to be infective¹¹. It has been suggested that people who excavate crypts should be vaccinated as a precaution¹², but vaccination has its own risks¹³. The initial assessment of risk, and subsequent exhumation of bodies buried in crypts, should, if possible, be performed by people who have been vaccinated in the past and have a resultant scar.

Any inhalation hazards associated with disturbing old interments are likely to be greater in crypts and other enclosed spaces than in the open air¹⁴. Pathogens associated with cadavers are likely to pose less risk than lead dust, and coffin wood, which may be contaminated with mould or parasite eggs, or powdered by wood boring insects. Protection against these hazards will also protect against any risk of infection with smallpox. Protective equipment should include overalls, head coverings, safety helmets, gloves, face shields, and high quality dust masks or respirators.

The recently deceased

Doctors (especially pathologists), technical staff in pathology, morticians, funeral directors, embalmers, and members of the emergency services are all exposed to risks from the recently deceased. The type of exposure and the risks involved vary with profession but staff of necropsy rooms, funeral directors, and embalmers are exposed most frequently. The conditions and pathogens that present particular risks include tuberculosis, group A streptococcal infection, gastrointestinal organisms, Creutzfeldt-Jakob disease, hepatitis B and C virus, HIV, and possibly meningitis and septicaemia (especially meningococcal). In general, following *Control Of Substances Hazardous to Health*

(COSHH) precautions^{14a} – especially the use of appropriate protective clothing – will greatly reduce the risk of acquiring infection, but some additional precautions may be advisable for particular infections.

Tuberculosis

Tuberculosis was probably the greatest killer amongst the infectious diseases in Victorian times¹⁵ and the number of notifications remained high until after the second world war¹⁶. The incidence of tuberculous infection in Britain declined steadily from 1850 until the late 1980s but, since 1987, notifications have risen¹⁷, possibly associated with an increase in the number of recent immigrants who are infected. It may also be due in part to an increase in cases of tuberculosis associated with HIV infection as has been seen in the United States¹⁸.

Opening cadavers infected with tuberculosis is dangerous. Several studies during the 1940s showed a high rate of tuberculin conversion among medical students and pathologists¹⁹⁻²¹. More recent surveys²²⁻²⁷ have all shown that, although the numbers of cases have fallen, workers in morbid anatomy, pathologists, and mortuary technicians remain particularly at risk²²⁻²⁷. This may be because aerosols, particles, and splashes containing tuberculous material can be generated during necropsies^{23,28}, particularly when power saws are used. This problem has apparently been reduced since the application of the recommendations advanced in the Howie report^{29,30} and increased safety precautions adopted because of concerns about bloodborne viruses. The embalming of people who have died of tuberculosis is unlikely to be hazardous because there is little aerosol formation but, because air may be expelled from the lungs of a body when it is lifted, it is recommended that the face of the corpse is covered temporarily with a disposable cloth. The incidence of undiagnosed tuberculosis in cadavers in developed countries is low³¹ but presents a hazard to mortuary staff, although probably not to embalmers. BCG vaccination is advised for mortuary attendants, pathologists, and embalmers.

Tuberculous infections of the skin of doctors who conduct necropsies, known as prosecutor's wart or verruca necrogenica (first described in 1826³²), were sufficiently common earlier this century to be mentioned in medical textbooks as a particular hazard³³ and are still reported occasionally³⁴. In the United States recently, a tuberculous skin lesion arose following a needlestick injury received during necropsy of a patient with HIV infection who had died of a strain of *Mycobacterium tuberculosis* resistant to seven antibiotics. Isolates from the lesion showed the same resistance pattern (Dale Morse, personal communication).

Meningitis and septicaemia

Meningitis can be caused by many organisms but the only ones that might present a hazard to those handling the dead are *M. tuberculosis* (see above) and *Neisseria meningitidis*. Septicaemia is commonly a terminal condition and can be caused by many different organisms (often the patient's own flora) most of which present no hazard to those who open the body or prepare it for burial or cremation. Only cases of meningococcal septicaemia or infection with group A streptococci pose a risk. The development of antibiotics has reduced the incidence of

fatal infections with haemolytic streptococci in the general population³⁵ but cases still occur in patients and mortuary staff³⁶ and may result from apparently trivial injuries.

Gastrointestinal organisms

Leakage of faeces from bodies is common. All who handle cadavers should wear gloves and impervious disposable aprons, take care not to contaminate instruments or their working environment, and wash their hands carefully after procedures and before eating.

Transmissible spongiform encephalopathies (TSE)

Two of these rare and fatal degenerative diseases are found in humans in the United Kingdom, Creutzfeldt-Jakob disease (CJD) and Gerstmann-Straussler-Scheinker syndrome. The causative agents of these diseases are poorly characterised but are highly resistant to most disinfectants and to heat. A related agent from domestic animals (scrapie) has been shown to survive interment for three years with a hundredfold fall in infectivity³⁷. The agent that causes CJD has been shown to survive well in formalinised tissue and the infection has been transmitted experimentally to mice by intracerebral inoculation of formalinised brain tissue from a human who died of the disease³⁸. It has been suggested that the use of phenolised formalin may reduce the risk³⁹ but recent guidance from the Advisory Committee on Dangerous Pathogens did not support this⁴⁰. The agent, once formalinised, has been shown to survive when a specimen is reduced to ash at a temperature of 360°C⁴¹. Exposure to sodium hypochlorite containing 20 000 ppm available chlorine (for at least one hour) to 1-2M sodium hydroxide, or steam autoclaving at 134°C for at least 18 minutes are needed for decontamination⁴⁰. CJD takes so long to develop that the evidence of risk to those who handle infected tissue is circumstantial, but reports have linked cases of this disease in morbid anatomy technicians to exposure at work^{42,43}. The Health and Safety Commission suggested recently that skulls of people who have died of CJD or other high risk infections should only be opened inside a large plastic bag fitted over the head and neck of the cadaver⁴⁴. As the prevalence of undiagnosed CJD in the population is unknown perhaps all skull opening should be performed in this way.

Hepatitis

Hepatitis A is transmitted by the faecal oral route and the same precautions should be taken as for other gastrointestinal pathogens. Vaccination is not essential, but maybe desirable for people who handle cadavers.

Hepatitis B is extremely infectious and transmission continues in many western countries. As little as 0.00001 ml pooled serum containing indicators of intact virus particles has been shown to transmit infection⁴⁵. Workers in clinical laboratories in the United Kingdom have had a higher incidence of hepatitis than the general population for 20 years, although the number of cases has been small²³⁻²⁶ and has fallen steadily in the past decade⁴⁶. One survey showed that technicians in morbid anatomy were particularly at risk²². In the United States in 1978 the rate of infection with hepatitis B in health care workers was four times higher than in the general population, and was particularly high in pathologists, surgeons, and others

exposed to blood or blood products⁴⁷. Skin penetration in the necropsy room occurs through contact with instruments, damaged bones, and bone spicules. A survey of embalmers in the United States showed that needlestick injuries were commonly reported and that 13% of embalmers were positive for anti-HBV (about twice the rate in a blood donor comparison group)⁴⁸. Workers in hospital mortuaries and embalmers should be vaccinated routinely against hepatitis B. The bodies of those who died of or were known to be infected with this virus should be handled only by workers wearing full protective clothing.

Hepatitis C is transmitted by the same routes as hepatitis B, but probably less infectious. Its incidence is unknown and no vaccine is available. Similar precautions to those for hepatitis B (full protective clothing) should be taken.

HIV

Hepatitis B and HIV are transmitted by similar routes and the precautions required to prevent the transmission of hepatitis B (full protective clothing) should be adequate to prevent transmission of HIV. HIV is probably about 100 times less infectious than hepatitis B and the risk to those handling infected cadavers is therefore proportionately less. A recent survey in the United States of health care workers with AIDS and HIV infections that may have been acquired occupationally showed that most documented exposures were to blood (91%) and that clinical laboratory technicians and nurses were most at risk⁴⁹. No embalmers or mortuary technicians had developed infection following documented exposure but three developed infections that may have been acquired occupationally. A serological study was carried out on embalmers who worked in an urban area of the United States where HIV infections were prevalent. Four out of 133 were HIV antibody positive, but these four individuals had other risk behaviours. Cadavers examined for medicolegal purposes may present a particular risk because many come from populations at high risk of HIV infection. Not all who die positive for HIV antibody are known to be infected at the time of death⁵⁰. The virus survives for many days after death in tissues preserved under laboratory conditions^{51,52}. Care should therefore be taken when handling unfixed material from HIV-infected cadavers, or when undertaking necropsies on cadavers infected with HIV. Embalming bodies of people known or suspected to have been infected is not recommended, and the effectiveness of embalming fluids against HIV in cadavers is unknown⁵³. The Advisory Committee on Dangerous Pathogens has published guidance on the risks associated with HIV⁵⁴.

Cadavers infected with HIV are often infected with other organisms, such as mycobacteria, which may be more infectious (albeit less dangerous) than the HIV infection itself.

Stillbirths

To what risks are fathers exposed when they handle stillborn babies as part of their grieving? The infectious diseases and organisms most likely to cause stillbirths, and possibly to contaminate stillborn babies, are rubella, syphilis, toxoplasma, cytomegalovirus, parvovirus B19, and *Listeria monocytogenes*. The father is likely to have

Table 3 Use of protective clothing

Hands	
Examination gloves (latex)	For handling hazardous material. Wear whenever handling bodies. Should be worn once only and then discarded. Always wash hands after use. Provide short term (10 minute) protection against formaldehyde.
Chemically protective gloves (nitrile)	Worn over examination gloves to protect from longer term exposure to chemical hazards, such as formaldehyde.
Respiratory protection	
Filter masks	Filter mask to EN 149 for specific hazards, such as lead dust, fungal spores, and aerosols.
Splash protection	
Face: visor	Protects against hazardous splashes to eyes, nose, and mouth.
Body: apron	If splashing to body may occur (hygienic preparation, embalming, collection of traumatised bodies, necropsies).
Feet: rubber boots	In wet situations (mortuaries, embalming rooms, collection of severe multiple trauma cases).
Whole body protection	
Gowns/coats	To protect clothing against splashing. Coverall with hood – to protect clothes and hair from impregnation with dusts, spores, etc.

Other protective clothing (safety helmets, boots, safety glasses, work gloves) should be worn as required to protect against mechanical injury.

been either the source of infection or exposed to it during the pregnancy as a result of living with the mother, and is therefore at little additional risk when handling the child. Basic cleaning of the cadaver, and possibly wrapping in a cloth, should reduce any small residual risk.

Reduction of risk

In the necropsy room

Obvious disease in a cadaver, or knowledge of an antemortem diagnosis of infectious disease, allows the pathologist to take suitable precautions, but covert disease remains a hazard.

The Howie report presented a detailed code of practice for the prevention of infection in laboratories and necropsy rooms²⁹. This report, and a subsequent report from the Health Services Advisory Committee (HSAC)¹⁴ and building notes from the Department of Health⁵⁵ together gave detailed protocols for the layout, construction, ventilation, and operation of necropsy rooms. In essence, hands should be washed routinely after each procedure and before eating (or smoking), the environment should be cleaned with a phenolic disinfectant daily, and instruments washed in a washer-disinfector, autoclaved, or immersed in a phenolic disinfectant for 20 minutes. A phenolic disinfectant is preferred to hypochlorite because hypochlorite is corrosive and may damage surfaces or instruments; cleaning large areas with hypochlorite may liberate unacceptable amounts of chlorine; and formaldehyde (likely to be found in necropsy rooms and on embalmers' premises) reacts with hypochlorite to produce a potent carcinogen, bis-chloromethyl ether⁵⁶.

In funeral directors' premises

Funeral directors are not currently given access to the certificate of the cause of death of bodies they prepare for burial or cremation. They need to know if an infection

hazard exists so that their staff may take precautions and they can decide whether embalming or hygienic preparation of the deceased and viewing by the bereaved are appropriate. A change of policy is needed.

Recommendations in the Howie report²⁹ and in the more recent HSAC report⁴⁴ did not fully address the hazards that face the funeral trade. They were concerned with necropsies, in which internal organs are exposed with inevitable spillage of blood and body fluids, sharp and power-driven instruments are used, and tissues and contaminated surfaces are flushed with running water. The hazards that face funeral directors and embalmers are similar but of a lesser order. The handling time for an individual cadaver is about one hour and embalming as practised in Britain is largely a closed procedure. Embalming reduces microbial activity and slows decomposition and is undertaken as a means of temporary preservation. A single abdominal wall incision is made in order to cannulate a major artery for introduction of a solution containing formaldehyde, and insert a drainage trochar into the heart and major body cavities. Drainage effluent is collected in a large closed vessel. The embalming of cadavers that have been in accidents or undergone postmortem examination (especially coroner's necropsies), is more difficult because they may be badly damaged and present particular hazards of damaged bones, bone splinters, and (occasionally) sharp items, such as needles, left in the body. Cosmetic work on cadavers, more common in the United States than in Britain, may also present hazards if the body has been damaged.

In this country up to 70% of cadavers are embalmed (more in urban than rural areas) but it is not always appropriate. For some notifiable diseases (table 1) and if the next of kin so wish, the cadaver simply undergoes "hygienic preparation." This involves washing the face and hands, dressing the cadaver, tidying the hair, and

possibly trimming the nails and shaving. Some ethnic groups require that relatives and religious leaders carry out their own hygienic preparation and rituals, and this may have to be done on the funeral director's premises. It seems unreasonable to restrict such activities unless an obvious hazard exists. The use of gloves and simple protective clothing by the funeral director's staff and anyone else who handles the bodies should be an acceptable and effective safety measure.

The funeral trade would be helped by simple guidelines appropriate to their activities and risks, which acknowledge the need to allow the bereaved friends and relations opportunities to pay their last respects in a safe and aesthetically acceptable environment. Universal precautions, a policy based on the assumption that any cadaver may be an infection hazard, has led to widespread use of body bags. Body bags slow the rate of cooling of cadavers, which allows decay to proceed more rapidly, and means that funeral directors often receive bodies in very poor condition. It is obviously desirable to place cadavers that pose a high risk of transmitting infection in bags. Universal bagging, however, prevents hygienic preparation of bodies and is undesirable, even when bags that permit the upper part of the body to be displayed are used. It renders final viewing impossible, unpleasant, or at least causes an offensive intrusion into a family's grief. Very few conditions make viewing by the bereaved an unacceptable hazard (tables 1 and 2).

All instruments used for embalming or preparing bodies for the funeral should be cleaned in warm water and detergent (if the water temperature is higher than "hand hot" it may fix protein onto instruments) and disinfected by boiling for five minutes or soaking in a phenolic disinfectant for 20 minutes. An autoclave, if available, provides excellent decontamination, but is not justified by existing levels of risk. Phenolic disinfectants should be used to clean up any spills of blood or body fluids, and disposable gloves should be used to protect the hands from contact with the spill. Hands should always be washed after finishing a session.

Environmental health departments are required to inspect the premises of funeral directors and are responsible for the observance of COSHH regulations. Embalmers' premises generally come under the Health and Safety Executive, but responsibility is delegated to environmental health departments in some instances.

Emergency service personnel

Spilt blood is the major hazard that emergency service personnel face from the deceased. The prevention of contact with blood with gloves, face and eye protection, and protective clothing as necessary should greatly reduce risks to personnel (including those from the funeral trade) who attend fatal accidents. Bodies that have been decaying for some time, particularly those which have been in water for some time, present little risk. The organisms likely to be present are their own body flora (particularly anaerobic bacteria) and organisms from water or the environment. Proper protective clothing will protect personnel who handle such material. Bodies should always be transported to mortuary facilities in waterproof body bags or fibreglass temporary coffins.

Summary of risk reduction

Whether dealing with old interments or with the recently deceased – and, in the case of the latter, regardless of which infectious agents may be present – observance of COSHH procedures^{14a}, the covering of cuts or lesions with waterproof dressings, careful cleansing of any injuries sustained during procedures, and particularly the use of appropriate protective clothing for the procedure (table 3), will greatly reduce the risk of acquiring infection.

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