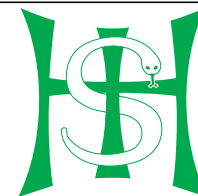




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Opinion

Casualties of war: the infection control assessment of civilians transferred from conflict zones to specialist units overseas for treatment

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SUMMARY

The casualties of global conflict attract media attention and sympathy in public, governmental, and non-governmental circles. Hospitals in developed countries offering specialist reconstructive or tertiary services are not infrequently asked to accept civilian patients from overseas conflict for complex surgical procedures or rehabilitation. Concern about the infection prevention and control risks posed by these patients, and the lack of a good evidence base on which to base measured precautions, means that the precautionary principle of accepting zero risk is usually followed. The aim of this article is to highlight infection control considerations that may be required when treating casualties from overseas conflict, based partly on our own experience. Currently there is a lack of published evidence and national consensus on how to manage these patients. The precautionary principle requires that there is an ongoing search for evidence and knowledge that can be used to move towards more traditional risk management. We propose that only by gathering the experiences of the many individual hospitals that have each cared for small numbers of such patients can such evidence and knowledge be assimilated.

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Introduction

Until violence ceases to be a method of resolving difference, war is an ever-present blight on the character of our race. In 2013, there were 33 active conflicts worldwide, with seven accounting for more than a thousand lives lost each in that year, and many more injured.¹ Most of these occur in poorer regions of the world where there is little resilience in the basic healthcare infrastructure, and little or no availability of specialist healthcare to support the rehabilitation of injured personnel. Both

governments and non-governmental organizations in developed countries have arranged at short notice the temporary transfer of civilian casualties with salvageable and recoverable injuries to specialist centres in their countries, offering services such as plastic and reconstructive surgery, treatment of burns, neurosurgery and orthopaedics. These patients may be infected or colonized with a variety of micro-organisms of infection control significance. Although some western countries have considerable recent experience of managing repatriated injured service personnel, the infection control risks presented by civilian casualties should not be considered to be comparable; the latter differ substantially in their pre-morbid levels of fitness and prior exposure to communicable diseases.

Most hospitals expect that patients transferred from war zones are managed such that they present zero additional

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infection control risk. The problem with this approach is that because the infection risks presented by individual patients are unknown, a highly precautionary approach to infection prevention and control must be used. In effect, hospitals apply the 'precautionary principle'.² This is an expensive strategy that may seriously interfere with the running of the hospital (perversely placing patients at clinical risk, while trying to protect them from an unquantifiable risk of infection).

Currently there is a lack of published evidence and national consensus on how to manage these patients. The precautionary principle requires that there is an ongoing search for evidence and knowledge that can be used to move towards more traditional risk management.² We propose that only by gathering the experiences of the many individual hospitals that have each cared for small numbers of such patients can such evidence and knowledge be assimilated. The aim of this article is to share some of our procedures, some applicable evidence, and highlight gaps in our knowledge base.

Assessing the risk

Receiving hospitals are usually given notice of receipt of transferred patients in two stages. First, there will be an early general request to take patients from the war zone; once a plan is made on the ground to transfer patients, hospitals will ideally get 48 h notice that patients will be arriving, but in reality this second period of notice may be much shorter. The key is therefore to start planning as soon as it is announced that patients may be transferred. As no specific evidence or guidance exists, infection control teams will likely draw upon a number of national guidelines relevant to transfer of hospitalized patients from overseas, the febrile returned traveller, and revise universal standard precautions.^{3,4}

The most important consideration in the risk assessment is what micro-organisms of infection control significance may be imported with the patient. Virtually all civilian casualties of conflict will have had some days of hospital treatment in their country of origin, and will be medically stable when transferred. The most obvious infection control risk they present is possession of multidrug-resistant bacteria, for which national screening guidelines exist.³ However, there are other important considerations. Blood-borne virus infections may be endemic in the patient's homeland, or the patient could be incubating such an infection acquired during locally delivered healthcare. A wide range of infectious diseases, sometimes exotic, may be present in the country of origin as well as the more mundane ones that complicate surgical procedures all over the world. Suitable sources of information on current disease outbreaks include ProMED-mail (<http://www.promedmail.org>), the Centers for Disease Control and Prevention (CDC) Travellers' Health Notices (<http://wwwnc.cdc.gov/travel/notices>), the World Health Organization (<http://www.who.int/csr/don/en>), and the National Travel Health Network and Centre website (<http://www.nathnac.org/countrysearch.aspx>). Tables I–III summarize important organisms with emphasis on the risk factors for carriage in transferred patients.

The risk assessment also needs to take account of the likelihood of the patient transmitting any micro-organisms of infection control importance. This in turn will depend on the general condition of the patient, and on what types of medical

or surgical care they will require. Usually transferred patients will be accompanied by at least one relative, and it is also important to consider the infection control risks that they could present to the hospital.

Managing the risk

Fundamentally, the control of infection from transferred civilians of conflict requires adherence to the same basic principles as in any other patient, with a few extra caveats.⁴

Placement of patients

Source isolation of transferred patients is mandatory, at least initially while screening and evaluation for the presence of organisms of infection control significance is performed. If more than one patient is transferred, it is usual practice to cohort isolate them on the assumption that they are at equal risk of having antibiotic-resistant bacteria. Cohorting permits camaraderie, which may make a bewildering, frightening time in a foreign hospital more bearable. The drawback is that infection control precautions will be required indefinitely for all cohorted patients, even if only one of them is initially colonized with an antibiotic-resistant micro-organism; this may have repercussions for planning operating theatre sessions, movement around the hospital for other reasons and the wearing of personal protective equipment by staff.

Because patients are likely to be medically stable on transfer, it is unlikely that they will require immediate intensive or high-dependency care. However, it is important to consider whether patients may require such care later during their admission, for example to recover after major surgery, and to plan for this eventuality where appropriate.

Screening of patients

Micro-organisms for which screening may need to be considered are summarized in Tables I–III. Patients should be screened as a minimum for MRSA and multidrug-resistant, extensively drug-resistant, and pandrug-resistant Gram-negative bacteria.⁷ Screening should be undertaken using methods as sensitive as possible; usually this will be by enrichment culture. Where rapid results would be clinically useful it may also be useful to screen using nucleic acid amplification tests, but these tests may not be sensitive enough for them to be recommended as sole screening tests.^{8,9} The need for further screening should be determined on a case-by-case basis.

Movement of patients around the hospital

The movement of patients around the hospital should be kept to a minimum; when unavoidable, precautions commensurate with the infectious risks posed by the patient should be employed. At least until the microbiological status of transferred patients has been established, they should be placed last on operating theatre or radiology lists, to provide adequate time for cleaning afterwards. It is not clear whether such restrictions on patient movement can be lifted – either following the receipt of negative screening test results or in those patients who carry drug-resistant bacteria – once wounds have

Table 1
Bacterial infections to consider in patients transferred from conflict areas overseas

Bacteria	Suggested screening sites	Suggested screening regimen
Multidrug-resistant, extensively drug-resistant and pandrug-resistant Gram-negative bacteria	Rectal swabs or faeces; respiratory secretions or throat swabs; wound swabs; urine	Three stool specimens or rectal swabs taken on separate days. Samples plated on to commercial chromogenic agar or tested by nucleic acid amplification.
MRSA	Nose, throat and groin/perineum swabs; wound swabs; swabs of indwelling device exit sites	On admission Consider PVL testing of MRSA strains in patients with recurrent suppurative infection
Glycopeptide-resistant enterococci	Rectal swabs or faeces	Three stool specimens or rectal swabs taken on separate days. Samples plated on to commercial chromogenic agar or tested by nucleic acid amplification.
Enteric pathogens: <i>Campylobacter</i> spp., <i>Salmonella enterica</i> , <i>Shigella</i> spp., Verocytotoxin-producing <i>E. coli</i> , <i>Vibrio cholerae</i> , <i>Aeromonas</i> spp., and <i>Yersinia</i> spp.	Up to three faeces samples	Suggest sending one stool sample on admission, regardless of whether formed or not, to ascertain if patient is colonized with enteric pathogens. Culture via validated technique or use nucleic acid amplification. Enrichment techniques should be used to detect salmonella carriage, even if NAATs are used.
<i>Mycobacterium tuberculosis</i>	Symptoms of active TB should be sought on admission with a chest radiograph if appropriate. Latent TB is most likely to reactivate in the first year following repatriation to temperate countries. If a patient from a high-incidence country requires prolonged rehabilitation, consideration of screening for latent TB should be given.	Obtain chest radiograph on admission. If patient likely to be admitted to healthcare facility for >6 months, suggest screen for latent TB using interferon gamma-release assay.

PVL, Pantan–Valentine leucocidin; MRSA, meticillin-resistant *Staphylococcus aureus*; NAAT, nucleic acid amplification tests; TB, tuberculosis.

Table II

Viral infections to consider in patients transferred from conflict areas overseas

Virus type	Suggested screening methods	Suggested screening regimen
Hepatitis B, C; HIV	Test serum for the presence of HBsAg, hepatitis C antibody and HIV antigen/antibody on admission (with consent). For patients who have received renal replacement therapy (RRT), blood transfusion, or had surgery in their state of origin within the last 12 weeks, repeat any negative tests 12 weeks following the original result. For those with ongoing need for RRT, treat as if the patient were a returned traveller who dialysed abroad if they underwent either RRT or blood transfusion in their country of origin. ^{5,6}	Gain consent for testing on admission to healthcare facility
Measles	Consider prevalence of measles in the country of origin. Measles IgG antibody measurement may be used to assess immunity.	Suggest measure measles IgG on admission and then a week later to confirm result
Polioviruses	Consider whether wild-type poliovirus is circulating in country of origin. Testing of faeces may be indicated.	Consult WHO list of countries in which wild poliovirus is circulating. If patient is at risk, send three stool specimens taken on separate days for enterovirus- or poliovirus- specific nucleic acid amplification testing.
Viral agents of gastroenteritis	Consider testing faeces only if symptomatic	Send liquid stool or vomitus for norovirus testing as part of the investigation of outbreaks of diarrhoea and vomiting if indicated
Varicella-zoster virus (VZV)	VZV IgG antibody measurement may be used to assess immunity	Send clotted blood on admission for VZV IgG unless confident about past infection status
Respiratory viruses, particularly influenza and Middle-Eastern respiratory syndrome (MERS) coronavirus	Establish case definitions, and test symptomatic patients as required	

HIV, human immunodeficiency virus; WHO, World Health Organization.

Table III

Parasitic infections to consider in patients transferred from conflict areas overseas

Parasite	Suggested screening methods	Suggested screening regimen
<i>Giardia</i> spp., <i>Cryptosporidium</i> spp., <i>Entamoeba histolytica</i>	Up to three faeces samples	Three stool specimens taken on separate days. Samples tested by conventional staining and microscopy techniques or by validated nucleic acid amplification if available.
Ectoparasites: lice and scabies	Clothes, hair, and skin should be thoroughly examined on arrival	

healed, patients are continent, and all indwelling devices are removed.

Clinical care

Consideration should be given to removing, culturing, and replacing where indicated, all indwelling intravascular lines and urinary catheters that are *in situ* at the time of admission. This recommendation is made on the presumption that such devices are unlikely to have been inserted and cared for to the standard of care bundles in western countries. Culture of

removed prosthetic devices may guide further antimicrobial therapy. Culture of urine from urinary catheters may help guide any antimicrobial prophylaxis administered prior to catheter change.

A plan for any empiric use of antibiotics before screening results are available may be required. Early antibiotic use is likely to be as surgical prophylaxis, rather than as therapy for suspected infection. For clean or clean-contaminated surgical wounds, the normal hospital antibiotic prophylaxis regimen may suffice, possibly supplemented with a glycopeptide if there is a high risk of MRSA. For contaminated or dirty wounds it

may be necessary to consider using broader spectrum antibiotics than normal, for example an anti-pseudomonal carbapenem and a glycopeptide. Drugs such as colomycin or tigecycline should probably not be used empirically as prophylaxis.

Cleaning

Risks of environmental contamination with drug-resistant bacteria need to be managed. Regular and thorough cleaning with a suitable disinfectant-based cleaning regimen is required during the patient's stay. Cleaning standards need to be monitored; this may be by visual inspection or use of ATP bioluminescence. Consideration also needs to be given to terminal cleaning of any facilities vacated by the patients, which includes operating theatres and other areas of the hospital that they have visited, as well as their bedspace. A thorough manual clean is required, but some centres have routinely used subsequent hydrogen peroxide or ultraviolet light.¹⁰ Environmental sampling post terminal clean should also be considered, although there is little evidence of which sites should be sampled and how. In our experience, some patients widely contaminated their environment with carbapenemase-producing organisms, which persisted despite standard cleaning procedures and only became culture negative from environmental sampling following hydrogen peroxide vapour treatment.

Accompanying persons

Any uninjured relative who accompanies that patient from their homeland may also present infection control risks related to many of the micro-organisms outlined in Tables I–III. They may be colonized or infected with micro-organisms of infection control importance, or they may become transiently colonized with the patients' micro-organisms. Because they are ambulant, they present different infection control challenges. Consideration needs to be given to their use of communal areas of the hospital, especially any facilities for visitors to prepare their own food or drinks; in our hospital we arrange for relatives to stay in a local hotel rather than in hospital accommodation, to ensure that they do not use communal kitchen facilities. We acknowledge that this strategy is contentious, but, in our experience, some patients and their carers from overseas do not reliably decontaminate hands appropriately despite careful counselling. There is evidence that visitors frequently touch surfaces, which may contribute to environmental dissemination of pathogens.¹¹

Patient information

The language barrier is an important consideration both for patients and for accompanying persons, and may hinder their ability to conform to good infection control practices. Consideration should be given to the use of an interpreter, and/or providing key information in written form in their own language.

Relaxation of infection control restrictions

The precautionary principle would dictate that patients should remain isolated throughout their admissions, but with

more experience and knowledge it might be possible to make recommendations as to when infection control measures could be downgraded. This might be where any patient has been found on repeated screens not to be colonized with antibiotic-resistant bacteria. Even if a patient is colonized with antibiotic-resistant micro-organisms, it may be possible to relax infection control precautions in some settings, such as rehabilitation.

Conclusion

The casualties of global conflict attract media attention and sympathy in public, governmental and non-governmental circles. Hospitals in developed countries offering specialist reconstructive or tertiary services are not infrequently asked to accept civilian patients from overseas conflict for complex surgical procedures or rehabilitation. Concern about the infection prevention and control risks posed by these patients, and the lack of a good evidence base on which to base measured precautions, means that the precautionary principle of accepting zero risk is usually followed. Maintaining this level of infection control is certainly expensive, and can interfere with the clinical care of the isolated and other patients. We suggest that a survey to obtain information on how different hospitals have managed civilian patients transferred from areas of conflict, and the infection prevention and control outcomes of these cases, offers the best chance of establishing an evidence-based approach to managing the infection prevention and control risks posed by these patients.

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Conflict of interest statement

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