

## Expedition Medicine

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### Introduction

**As a member of the Defence Medical Services you may be called upon to support or advise an expedition and therefore, act as a guardian of an expedition's health (1). This article will look at the generic issues within the provision of expedition medicine, with specific environments, such as altitude, heat and cold, being addressed in detail elsewhere in this supplement and previous JRAMC publications (2,3). It will consider factors that must be thought about to make the medical support to an expedition complete and explore areas where early and simple contemplation of potential problems will prevent, as far as possible, unexpected and potentially catastrophic problems from arising. As with military operational medicine, with which there is significant and substantial overlap, this can be broken down into three simple areas; the mission; the environment; and the personnel. These areas will be highlighted with vignettes based on real life experiences that we have encountered in providing medical support to a variety of expeditions, both military and civilian. This article is written with particular advice for the military expedition but examples from non-military ventures are used to highlight salient points which are equally applicable to both type of trip. Many trips do not utilise doctors for medical support (4) and this paper is written for any person providing medical support to an expedition.**

### Background

With the rapid rise in the "adventure culture", the ease of access to remote wilderness environments (4,5) and the marked fall in worldwide air fares there have never been more people travelling and exploring. To cater for this ever expanding market there is certainly no shortage of commercial and non-commercial providers to offer challenging itineraries in austere and exotic locations. The term expedition evokes thoughts and images of personal challenge, pitting oneself against nature's forces and has been described as "an organised journey for a specific purpose" (6). In more recent times these challenges are often associated with a charitable aim (Figure 1). Expeditions provide a

powerful marketing tool for commercial or charitable companies and are equally attractive for any group or organisations looking to improve team building skills and personal development amongst its personnel. Nowhere is this more so than in the military environment.

As a result of the ease of travel, the 21st Century explorer cannot be easily defined and the boundaries between holidays and expeditions have become increasingly blurred and there is considerable overlap between adventure travel and leisure travel (7). Whilst not wishing to suggest the restriction of these challenges to the super fit and young, the presence of less fit, older participants, many with pre-existing medical conditions, does raise a number of new and often complicated clinical scenarios for those who provide medical support to these expeditions. Service personnel are not immune to these changes and medical personnel may wish to undertake a working holiday on a commercial venture. Military personnel may also have underlying chronic illness compatible with service life and it should not be assumed that a military expedition will be made up purely of the physically fit. It must also be remembered that military personnel may also be under 18 and there may well be both male and female participants. These issues must be considered when addressing expedition planning and risk assessment.

### Case 1

Whilst on a Tri-Service transatlantic sailing expedition a member of crew was sent up the mast to replace a halyard rope. Unfortunately they became detached from the safety harness and clattered into the spreader bars. As a consequence they experienced significant potential trauma to the abdomen and back. They reported numbness in their lower limbs and significant left upper quadrant/lower left chest pain. This was worse on inspiration. Clinical examination, after clearing C-spine injury, reproduced significant pain in the region, described however, neurological examination was normal for all limbs and no other clinical signs were elicited. The patient was pale with a capillary refill time of 3 seconds; BP was 90/50 mmHg, pulse 120bpm, respiratory rate 30 bpm. It was 45° C on deck and 35° C below.

Decisions on how far to press ahead with a mission with an affected member of the expedition team will depend on the aim of

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Fig 1. University of Nottingham Medical School Charity Expedition to Kunde Hospital, Khumjung, Nepal 1998.

the expedition and practicability of the potential alternatives. In the situation above we were 4 days into a 21day trans-Atlantic trip and over 24 hours from help (by US coastguard), we had a single litre of colloid, 2 litres of crystalloid and a differential diagnosis including splenic rupture (3). Intense discussions about potential options (between the skipper and medical provider) included turning round (and ending the expedition for that crew) to return to shore or to facilitate possible helicopter evacuation, calling the US coastguard to arrange evacuation and pressing onwards. It was decided that after 15 minute observations the decision would be guided by any deterioration and would in the event of a worsening clinical picture involve a call to the US coastguard and turning around. Potent analgesia was given and the observations remained stable. The crew member was given 72 hours rest, continued regular analgesia and encouraged to only return to the role of crew when and if they felt better. If splenic rupture had occurred the likelihood of survival in this scenario would probably be low. This in fact made the decision easier in a way as there was little that the US coastguard could do and, therefore, continuing was probably the best option. In the worst case scenario, i.e. a death on an expedition there are clearly medical, legal and administrative consequences that need to be considered. On return to the UK the crew member was diagnosed with fractures to the left lower ribs.

### The Mission

One of the more difficult aspects of medical planning for expeditions is the need to balance safety and risk with the desire to pursue physical and mental challenges but also to balance the needs of the individual versus the desire of the group to achieve its aim. The risk on a well-prepared and planned expedition is similar to those encountered during

normal active life (8). Failure to achieve the stated aim of an expedition is often seen as an overall failure and occasionally as a reason to demand compensation or a refund. This additional burden must be considered by the medical provider prior to departure and not be ad hoc on the ground often when under significant pressure from others, ultimately the medical provider must maintain some professional distance from other expedition members (7). If in doubt about the best course of action, or if moral support is required, then call a fellow doctor or senior colleague (even if in the UK) to get reassurance and/or the confidence to stand up for whatever you believe to be correct clinical decision. Even the most experienced expedition doctors need reassurance at some time.

When explicitly providing support to an expedition it is crucial that you have a plan for evacuation and insurance to cover the associated costs. This needs to be openly discussed with the expedition party (and in detail with the expedition leader), ideally prior to departure. If someone does need to be evacuated who is to escort the patient? If you (the medical provider) leave the expedition and a second member of the party requires medical assistance who will provide medical care in your absence? These questions all fall under the consideration of the mission.

### Case 2

Whilst a participant on a week long rafting trip on the Sun Khosi River in Nepal a female participant presented with sudden onset shortness of breath in the early hours of the morning. She had been drinking heavily and smoking cannabis. She spoke very limited English and her travelling companion said that she had been behaving strangely immediately prior to her sudden breathlessness. She also said that she was asthmatic and had an inhaler. Another member of the trip had been stung by a scorpion earlier that evening. On examination she had a respiratory rate of 30 breaths per minute, no apparent wheeze or stridor. There did not appear to be any obvious bite marks but examination was limited in the dark with a torch.

There are several differential diagnoses in the above situation ranging from an acute asthma attack, a simple panic attack (possibly brought on by fear or phobia of scorpions) through to a pulmonary embolus (in a young girl who may be on the pill), true envenomation (and possible anaphylactic/oid reaction) from a scorpion bite or even an acute psychiatric reaction precipitated by cannabis.

In this case the isolation from medical facilities (the nearest hospital is 24 hours away by road), lack of personal medical kit (except personal first aid kit) and lack of awareness of the medical kit being carried by the expedition staff all compound the man-

agement and diagnosis of the clinical problem. In planning medical support to a similar trip these areas would fall under consideration of the environment. Your medical pack contents would be guided by the expected risks in the terrain you are exploring, access to medical facilities, local pathogens and should cover the most likely potential scenarios you might face. On a military expedition however, you may inherit an expedition medical pack from the previous leg of an extended expedition (as was the case in the first vignette) and, therefore, have a limited input to its content.

Additionally, in the second situation, there is no past medical history available and communication was limited due to intoxication, acute breathlessness and the obvious language barrier. Some of these areas may be less likely in a military environment but would also be negated by having a documented list of pre-existing problems for all participants prior to departure. This falls under consideration of the personnel and one of the most valuable aspects of pre-expedition planning is meeting your fellow personnel to determine pre-existing pathology to minimise surprises when on the trip itself. In this instance there is only a limited amount that one can reasonably be expected to do. With only limited resources available she was treated initially with her inhaler and then with breathing control manoeuvres. Although adrenaline was available in the expedition medical pack it was decided to observe before further treatment. She settled down and had no further episodes during the trip and a presumptive diagnosis of an acute panic attack was made. Advice was given as to abstaining from cigarettes and cannabis, both of which the woman chose to ignore.

In this scenario the lack of ongoing problems is fortunate, faced with further deterioration or lack of resolution you may be faced with arranging transfer to a medical facility. As the medically qualified individual this may mean that, even though you are not there to provide medical support, your expedition is over. On an expedition where you were the medical guardian the question of ongoing medical support is again raised.

Unusually for this kind of situation information on later events became available through the travelling companion. She explained that on arrival back in Kathmandu the woman in question had a further episode of acute psychosis after cannabis use and was ultimately repatriated by her insurers after being admitted as a psychiatric case in a local hospital. It also became clear that she had a past history of psychiatric illness related to significant cannabis use and schizophrenic type behaviour.

### **The Environment**

When planning medical support for an expedition the first consideration that comes to

mind is usually related to the physical terrain that is likely to be encountered and the activities that the expedition is going to carry out. There may be inherent risks associated with the environment, such as hypoxia at altitude or heat illness in the desert, but that may only be part of the equation. Some activities, such as mountaineering, will obviously carry additional risks but even sedate activities may hold additional risk in austere environments, for example trekking at extreme altitude or in extremes of temperature. Other common medical problems include road traffic accidents, falls and other injuries and infections.

In remote environments it is sensible to have a clear idea of the flora and fauna that may be encountered. This includes consideration of type of snakes, scorpions and insect vector borne diseases that are endemic in the region being explored. Specific briefs to expedition members on these hazards should be performed and any preventative measures, such as personal mosquito nets, should be emphasized as crucial in minimizing the risk of preventable pathology. It is also wise to have an idea of locally endemic illnesses such as gastrointestinal pathogens, HIV/AIDS prevalence, malaria, TB and specific local hazards such as bilharzia, antibiotic resistance patterns and infectious diseases that require vaccination prior to departure. (For further specific information see useful websites at Appendix 1).

Another area of critical importance when planning expedition medical support, and one that is often overlooked is consideration of local food and water supply. Consideration of these two areas must include whether there will be a safe potable water supply (both at the city of entry and before the expedition proper) that is free of pathogens such as *Giardia* and whether water purification methods or bottled water need to be considered when on the expedition itself. As in most travel medicine briefs it is essential to explain to participants, in some detail, the need to avoid uncooked or undercooked foods, reheated foods, and, in areas where the local water supply is presumed contaminated, salads, ice cream, drinks with ice cubes etc. Again, whilst not wishing to curtail people's freedom to try local delicacies it only takes a single person to present with a bout of "Delhi belly" to decimate an expedition when people are living in close confines with only basic sanitation facilities. This leads on to another area of critical importance, that of personal hygiene which will be covered in detail in the section on personnel below.

An assessment of local medical facilities (Figure 2) should be carried out pre-departure or, if not possible, immediately on arrival in-country. As outlined in the second vignette accessibility is often a key consideration and as alluded to earlier in this paper consideration of evacuation at any point

along the expedition must be thought through carefully. Phone numbers of key facilitators must be readily available, at minimum those of the relevant in-country emergency services, the local British consulate or high commission (with whom early contact should be made if a military expedition) and contacts of senior colleagues or further advice in the UK. The possibility of telemedicine should also be considered and may be of particular use to more junior doctors or allied health professionals. Consideration of tri-band mobile phone technology and/or satellite phone communications should be



Fig 2. Local Hospital, Phortse, Everest Valley, Nepal.

considered. Finally an understanding of usual cultural practices including spirituality, health beliefs and role of women in society should also be explored before departure to help assess whether care provision is likely to be adequate and acceptable to the expedition party.

Even if health facilities are accessible and available the quality of local healthcare provision may well be very basic with very limited

drugs and supplies available. Consideration of HIV/AIDS must be considered in trauma patients and rapid transfer to an appropriate facility (often an international hospital or private facility) should be ensured to minimise patient risk. The areas of medicine that should be considered are the same as those required of the RMO on a standard operational tour (outlined in Figure 3). The standard of medical training will also vary from country to country and should be weighed against rapid transfer to a facility with appropriate expertise for the clinical problem. Having said all of the above there are often excellent health facilities and competent staff in remote and unexpected places.

### Case 3

Whilst attempting to climb to the base camp of Cho Oyu (altitude 5500m) a member of a small group of trekkers becomes increasingly tired, lagging behind and frequently appearing to stumble. On stopping for a break they appear to be acting as if intoxicated and stumbling. Further assessment reveals ataxia and on suggestion that they return to a lower altitude, as this may represent signs of acute mountain sickness and high altitude cerebral oedema, the affected individual becomes aggressive and belligerent and demands to keep on going to reach their agreed destination. After much pleading they agree to turn back before acutely deteriorating and requiring treatment with nifedipine, dexamethasone and acetazolamide and subsequent evacuation to the local Himalayan hospital and treatment within a Gamow Bag.

### Personnel

When considering participants on an expedition and the medical support expected and required it is important to consider the type of expedition you are supporting. This may be a military expedition with all participants from within your own usual area of responsibility (regiment, unit, garrison or station); a military expedition with a disparate group of participants i.e. single service or tri-service expeditions, with participants meeting only hours prior to departure; it may be a commercial expedition where contact with participants prior to departure is possible or a commercial trip where you only meet the participants in-country. It may also be as a group of friends, as in the final example, and the need for professional distance, as the medical provider, is again highlighted.

Within a military environment you may hope that due to an in-built selection there will be little or no chronic illness, but this should not be taken as read. Anecdotally it is often the fittest individuals who succumb to illness or suffer at altitude and fitness alone does not exempt one from illness. Many military personnel do have ongoing medical needs and chronic problems compatible

### Model of Military Primary Care

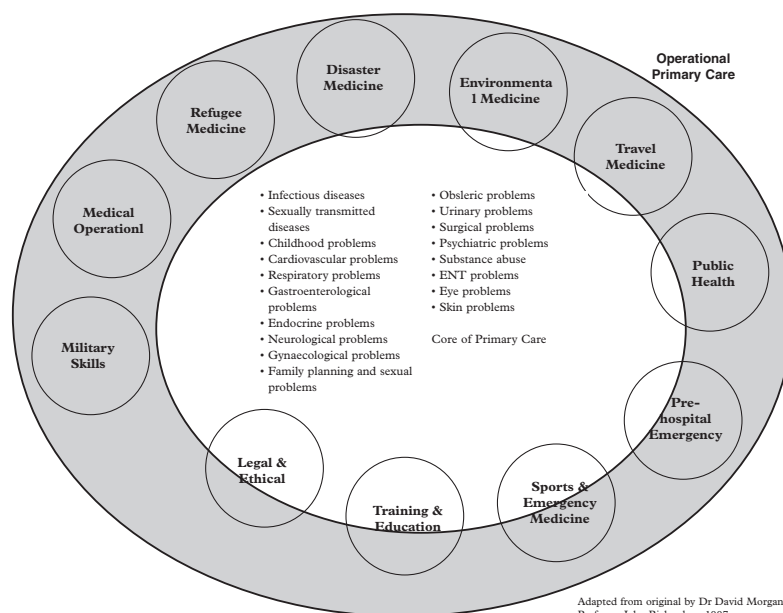


Fig 3. Model of Service Primary Care: All relevant for consideration on a Military Expedition. (Reproduced with kind permission of Lt Col D Morgan-Jones and Prof J Richardson)

with service life and this should not be overlooked in planning and tailoring your support for the expedition participants. On commercial expeditions this is clearly not the case and the health screening carried out prior to final acceptance on a trip may be very scant indeed. Regardless of the type of expedition a pre-assessment health questionnaire to highlight ongoing and current health needs of all participants is invaluable and must include dental as well as health assessment. Ideally face-to-face consultations with those who have individual health needs should be arranged to allow a physical examination and an opportunity to discuss special arrangements and personal medical supplies, as well as, ultimately, the suitability of the individual to undertake the expedition. The needs of the individual need to be balanced against the need of the expedition in assessing suitability and is often a difficult area to address. If face-to-face consultations are not possible telephone contact should be made with participants and a decision made (pending an examination locally) as to their needs and suitability. With this information adequate consideration can be given to specific medicines and equipment required for the trip.

Another key step in informing all participants of health considerations should be a group brief. Ideally this should be performed some weeks, if not months, prior to departure and should include issues such as environmental issues discussed previously but also personal health insurance, vaccinations required and personal medical kits. Particular emphasis should be placed on personal hygiene (9), particularly hand washing and the reporting of gastrointestinal illness to the medical provider early (so that they are not to undertake any cook duties etc.). If the medical pack is to be large then considera-

tion should be given to whether one large pack should be taken or whether some of the kit can be divided between members of the expedition party. There are pros and cons to each approach but prior thought may make logistics easier.

The issue of confidentiality can be difficult on expeditions and discussion prior to departure can be helpful, in particular it should be explicitly stated and accepted by all participants that medical confidentiality will include the expedition leader (on a need-to know basis) should the expedition be potentially affected. The use of a buddy system can also be helpful and allows group members to share concerns with each other and look out for each other. This is particularly useful if someone has a chronic condition that they are concerned about but do not want to discuss with the entire party. Particular thought should be paid to contingency plans if the medical provider becomes ill and needs evacuation, and in expeditions where the leader is also the medical provider thought should be given to whether a second healthcare provider should be on the team.

A clear plan for the treatment of locals should again be thought about prior to departure, as a rule of thumb life, or limb, saving treatment should always be performed if competent, and local intervention that is quick and easy should also be considered. Any intervention however, that raises the expectation of health provision outside what is available locally or any treatment that is likely to be prolonged should be avoided. It is ultimately a personal decision as to whether to treat locals but one that should be considered may have potential longer term ramifications (Figure 4). It must be remembered though that if one travels as an expedition medical officer there would be no “Good

Box 1. Suggested basic equipment.

No	Description	Comments
1	Analgesia	All sorts, remember caution with NSAIDs and asthmatics, check the legality of carrying opiates (particularly into the USA)
2	Antibiotics	Wide spectrum, but remember allergies. Local microbes should determine specific choice, consider small supply of IV antibiotics for emergencies
3	Anaphylaxis	Life threatening but potentially treatable
4	Anti-emetics	Different routes of administration, avoid metoclopramide in young people
5	Fluids	Limited due to weight, don't forget giving sets and make sure you know how to put them together
6	General Medical	Asthma, diabetics, cardiac conditions etc, guided by your pre-assessment questionnaire, infection control, i.e. antimalarials, dengue
7	Minor Surgery	Scalpels, steri-strips, sutures and suture kits, local anaesthetics
8	Spinal injuries	C-collar, improvised splints
9	Wound care	Dressings and creams, vital and often forgotten
10	Suncream	Suncream and aftersun – lots of it, high spf
11	Insect	Zovirax, repellents, DEET, Permethrin
12	Sexual and Reproductive medicine	Morning after pill, condoms, Canesten cream.



Fig 4. Local Nepalese Children, Sun Khosi River 1998.

Samaritan” cover, even if no payment is given. Any medically qualified person treating any patient has a duty of care and whilst there are no standards of care for expeditions they “need to practice the ordinary skill of an ordinary competent individual exercising that particular act” (10).

### Medical Kit

Non-traumatic disease is the most common complaint on most expeditions with minor accidents and trauma being less common (11). There is no magic formula to putting an expedition kit together and different trips will require different equipment. It requires time and considerable reflection on the types of illnesses and injuries that may be encountered (7). As an outline however simple treatments such as those in Box 1 should form the mainstay of your basic kit, for information a further kit list for a trans-Atlantic trip for 12 people for 3 weeks is outlined in Appendix 3 for idea of scales (3). Further suggestions are contained in the excellent articles by Shaw and Dallimore (7), Illingworth (12), Zell (13), A’Court (14) and Wallis (2).

Box 2. Specific consideration for the following environments should also include:

No	Description	Comments
1	High Altitude	Oxygen (if over 6000m), Acetazolamide, Nifedipine, Dexamethasone, A beta-agonist and NSAIDs
2	Tropical areas	Iodine solutions, antiserum, Mosquito nets and Permethrin
3	Desert	IV fluids, eye protection
4	Diving	Chest drain and ventilation equipment, Aluminium acetate, Distilled water, Antibiotic eardrops, decompression facility information
5	Sailing	Fluids, sunblock and sunscreen (spf 50), hand creams, antiemet ics, topical antibiotics
6	Caving	Anti-histoplasmosis treatment

### And Finally....

It is important to protect yourself, do not forget your own needs on an expedition and remember that you are also there to enjoy yourself and be part of the overall team effort to complete the expedition. Make sure you

are comfortable in the environment that you are providing care in, and do not become a liability to the expedition by being ill-prepared yourself. There are many good courses on travel and adventure medicine and numerous sources of robust information and outdoor skills training. Prior to departure make sure you have informed your medical indemnity organisation and have adequate expedition insurance, make sure you have got your contacts in the UK and in-country sorted out, organise your kit, brief your team as regularly as necessary and if you have considered the generic information in this article you will be well prepared to experience the enjoyment and exhilaration of the expedition along with all the other members of the team. If there are medical problems on your expedition do not forget to follow them up on your return and advise expedition members what to do in the event of ongoing problems. Up to 55% of all travellers may develop some sort of health problem post expedition (15) and you still have a duty of care to advise them on where to seek appropriate help on their return.

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## Appendix 1

Useful additional sources of Information

### Books

Auerbach P.S Wilderness Medicine 4th ed. Mosby St Louis Missouri 2001.

Health Information for overseas travel, DoH, HM Stationary Office.

Immunisation against Infectious Disease, DoH, HM Stationary Office.

Health Information for International Travel, CDC, Atlanta, USA.

### Websites

Department of Health travel Department, [www.doh.gov.uk/traveladvice](http://www.doh.gov.uk/traveladvice)

TRAVAX, Scottish Centre for Infection and Environmental Health, [www.travax.scot.nhs.uk](http://www.travax.scot.nhs.uk)

US Centre for disease prevention and control, [www.cdc.gov/travel/index.htm](http://www.cdc.gov/travel/index.htm)

US State Department, [www.travel.state.gov/travel\\_warnings.html](http://www.travel.state.gov/travel_warnings.html)

World Health Organisation, [www.who.int](http://www.who.int)

UK public health laboratory Service, [www.phls.co.uk](http://www.phls.co.uk)

Liverpool School of tropical medicine, [www.liv.ac.uk/lstm.html](http://www.liv.ac.uk/lstm.html)

London School of Hygiene and Tropical Medicine, [www.lshtm.ac.uk](http://www.lshtm.ac.uk)

International Society of mountain medicine, [www.ismmed.org](http://www.ismmed.org)

Wilderness Medical Society, [www.wms.org](http://www.wms.org)

Royal Geographical society, [www.rgs.org](http://www.rgs.org)

British Mountaineering Council, [www.thebmc.co.uk](http://www.thebmc.co.uk)

### Publications

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## Appendix 2 Pre-exped questionnaire

**MEDICAL IN CONFIDENCE WHEN COMPLETE**

**MEDICAL MATTERS**

**EXERCISE WILD MOUNTAIN**

Do you have any CURRENT medical problems?	
Have you had any illnesses or operations in the past year?	
Are you ALLERGIC to anything?	
Do you take any MEDICATION regularly?	
Have you ever experienced any problems at altitude?	
Have you ever suffered from (diseases)?	
Do you have any DENTAL problems? *	

If you answered 'yes' to any of the above, please give details below:

**ANY OTHER COMMENTS:**

Everyone must see a dentist to ensure that any dental work e.g. Fillings/ bridges is completed prior to departure.

**Appendix 3****Exercise Southern Tartan Medical Supplies****1. Analgesia**

Diclofenac 75mg/3ml	2
Diamorphine 10mg/10ml	10
Naloxone 400mcg IV	10
Cocodamol 8/500mg	120
Ibuprofen 400mg	200
Paracetamol 500mg	200
Aspirin 300mg	100

**2. Antibiotics**

Amoxicillin 250mg tab	105
Flucloxacillin 250mg tab	112
Ciprofloxacin 250mg tab	100
Metronidazole 400mg tab	50
Metronidazole 500mg IV	9
Cefuroxime 750mg IV	15
Benzyl Penicillin 600mg IV	25
Chloramphenicol eye 0.5% drops	3

**3. Anaphylaxis**

Epinephrine 0.3ml 1/1000	2
Epinephrine 10ml 1/10000	3
Hydrocortisone 100mg IV	8
Chlorpherinamine 10mg/ml	5

**4. Antiemetics**

Prochlorperazine maleate 5mg tablets	84
Hyoscine 1.5mg patch	5
Cinnarazine 15mg tablet	84
Hyoscine 300mg tablet	24

**5. Burns**

Flamzine	4
Jellnet gauze	4

**6. Fluid Resuscitation**

Normal Saline 0.9%	2L
Gelofuscin 500ml	2
NaCl 0.9% Flushes/Venflons	20
Dioralyte sachets	80

**7. General Medical**

Prednisolone 5mg EC	56
GTN 400mcg Spray	1
Omeprazole 20mg	56
Salbutamol 100mcg inhaler	2
Beclomethasone 100mcg	
Diazepam 5mg/2ml	10
Loperamide 2mg	30
Chrotamiton 10% 30mg	1

**8. Minor Surgery**

Gloves Sterile	3
Examination gloves	10
Fine Suture Set	1
Sutures Various	20
Glue	3
Dressings assorted	15
Saline Sachets	20
Syringes 2ml/5ml/10ml	20
Bandages Various/Tapes	10
Steristrips various	5
Lignocaine 1% 10ml	5
Lignocaine/Epinephrine	5

**9. Spinal/Trauma**

Set of stiff neck collars	1
Guedel Airways	6
Oxygen – aboard ship	1
Laerdal Mask	1

**10. Miscellaneous**

Stethoscope	1
Sphygmomanometer	1
Pulse Oximeter	1
Auroscope/Otoscope	1
Giving sets	2
Small sharps Bin	1