Clinical

Infective skin conditions in an adult sea-going population

An overview of the most common infective skin conditions seen within the adult sea-going population, their diagnosis and management, including special considerations for Naval personnel.

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Abstract

Infective skin conditions represent a significant element of the caseload for sea-going and shore-side clinicians. They are common within the wider military setting due to the frequent requirement to live in close proximity to others in conditions which favour the spread of skin and soft tissue infections (SSTI) (1, 2). Within the UK civilian population, 24% of individuals see their family doctor for skin conditions each year, accounting for 13 million primary care consultations annually. Of these, almost 900,000 were referred to dermatologists in England in 2009-2010 and resulted in 2.74 million secondary care consultations (3).

Several recent articles have highlighted the problem of Panton-Valentine Leukocidin Staphylococcus aureus (PVL-SA) infection and carriage in sailors on submarines, and soldiers deployed to Afghanistan (4, 5). However, the majority of published articles relate to land-based military personnel. This article aims to provide an overview of the most common infective skin conditions presenting among Naval personnel (based on the authors’ experience), illustrated by several case studies, together with an approach to their diagnosis and management.

Introduction

Skin infections can be broadly classified by their causative organisms, namely bacterial, fungal, viral and parasitic. The skin of patients is often colonised by one or more of these organisms without causing symptoms. However, upon breaching the protective epidermal or mucosal barriers, due to mechanical injury, immunosuppression or a bite/sting, infection can occur (6).

When describing skin lesions, a basic understanding of dermatological descriptive terms is essential. Box 1 outlines an approach to this (6).

<table>
<thead>
<tr>
<th>The ‘5 S’ approach to describing skin conditions</th>
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<tbody>
<tr>
<td>Site, Shape, Size, Surface, Surrounding skin</td>
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<tr>
<td>Scale – dry, flaky skin surface</td>
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<tr>
<td>Vesicle – clear fluid blister &lt;10mm in diameter</td>
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<td>Exudate – fluid leaked from a lesion (e.g. serum, pus, blood)</td>
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<tr>
<td>Crust – exudate once it has dried</td>
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<tr>
<td>Erythema – reddening of the skin</td>
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<tr>
<td>Papule – a raised lesion &lt;10mm in diameter</td>
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<tr>
<td>Pustule – a pus filled blister &lt;10mm in diameter</td>
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<tr>
<td>Plaque – a raised and thickened lesion &gt;10mm in diameter</td>
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<tr>
<td>Onycholysis – nail plate separation from the nail bed</td>
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Case Study 1

A 23-year-old female AB attends fresh cases complaining of several lesions with honey-coloured crusts around her mouth. She first noticed them 48 hours ago, and thought at first that they were spots. She is concerned as they do not look like normal spots now. She is otherwise systemically well. She recalls that she saw her one-year-old nephew several days ago who had some similar looking lesions around his mouth (Figure 1).
Impetigo
Impetigo is a superficial bacterial skin condition caused by Staph. aureus and/or Strep. pyogenes (6). It typically presents with honey-crusted lesions if caused by Staphylococci, or ulceration and crusting with Streptococci (7). Rarely, the infection can be more severe causing bullae or deep ulceration. It is highly contagious, and is typically transmitted through contact with another infected person.

It can be treated with hygiene advice alone in mild cases (Box 2). Moderate cases may warrant treatment with topical fusidic acid. More serious cases can be treated with oral flucloxacillin, or clarithromycin if the patient is penicillin-allergic (8).

Case Study 2
A 32-year-old Petty Officer attends fresh cases complaining of a red rash, pain and swelling of his left shin. He grazed it on a hatch two days ago after he had been to the gym, and has noticed that the area has become red, swollen and painful within the last 24 hours. On examination, he has a 5 x 8cm well-demarcated area of erythema. It is warm to touch and tender. On palpation, he has enlarged lymph nodes in his left groin, and his temperature is 37.9°C (Figure 2).

Cellulitis
Cellulitis is swelling and erythema of the skin and subcutaneous tissue caused by a localised infection. The most common organisms involved are S. pyogenes (two-thirds of cases) and Staph. aureus (9). It is usually preceded by local tissue trauma or irritation to the skin (e.g. eczema, oedema or venous disease). The skin becomes red, warm and tender. There is usually swelling of the surrounding tissues and a well-demarcated border between the erythema and normal skin is often visible. This should be marked in order to provide a reference for any expansion or resolution of the infection. The patient may also be systemically unwell and febrile. Most cases can be treated with oral antibiotics. Flucloxacillin is the antibiotic of choice in more severe cases (500mg QDS for seven days), or co-amoxiclav (125/500 TDS for seven days) for milder cases. Penicillin-allergic patients may be given erythromycin (500mg QDS for seven days) as an alternative (10). If the cellulitis is thought to have been caused by salt water contamination of a wound, doxycycline (100mg BD) should be added to the antibiotics above (10). Systemically unwell patients with spreading cellulitis should receive intravenous (IV) antibiotics and be admitted to hospital (Box 3).

Case Study 3
A 21-year-old Royal Marine who has just arrived on board ship at the end of an exercise presents to sickbay complaining of a painful boil in his left axilla. He has been living in field conditions for the last week, and first noticed it yesterday. On examination, he has a small boil with minimal surrounding erythema. He is systemically well and as you feel that the

Box 2.

<table>
<thead>
<tr>
<th>Impetigo</th>
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<tr>
<td>This condition is extremely contagious. Fastidious hygiene measures must be emphasised to patients to avoid further spread and isolation should be considered in severe cases. Activities such as group exercises on shared floor matting should be avoided until the lesions have healed.</td>
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Figure 2. Cellulitis, left lower limb (Source – DermNetNZ)

<table>
<thead>
<tr>
<th>Cellulitis</th>
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<tbody>
<tr>
<td>Severe cases at sea requiring IV antibiotics warrant prompt CASEVAC. Consider PVL-S. aureus if the infection is particularly aggressive or resistant to treatment (see below). Patients may require formal medical downgrading until they have recovered. Consider adding doxycycline to the patient’s treatment if any salt water contamination has occurred.</td>
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Box 3.
boil is too small to warrant incision and drainage, you give him oral antibiotics. The following morning, he re-attends complaining that the rash under his arm has spread significantly and he feels “awful.” On examination, he has a fever of 40.10°C, is tachycardic and appears septic. You cannulate him, start IV antibiotics and fluids and arrange for an urgent CASEVAC to the nearest hospital. He is admitted to ITU on arrival where he spends several days receiving high-dose IV antibiotics.

PVL-SA
PVL-SA is a toxin produced by certain types of *Staph. aureus*. It can destroy white blood cells and cause significant tissue damage. It is spread by the 5 Cs: Close contact (skin-to-skin or contact sports); Contaminated items; Crowding (e.g. close-packed messing on ship); unCleanliness; and Cuts and grazes (11).

It may present initially as cellulitis, abscesses, boils, folliculitis, an infected wound or as severe necrotising pneumonia. Patients may become severely unwell and PVL-SA should be suspected with severe or recurrent infections. Cases have been reported recently within the sea-going population and military fatalities have occurred (1, 4-5). If suspected, swab the wound as well as the patient’s nostrils. Ensure that the microbiology request includes testing for PVL-SA. For mild cases oral antibiotics will be adequate in most instances (seven days of flucloxacillin 500mg QDS or clindamycin 450mg TDS) (11). Abscesses should be incised and drained. If the patient is systemically unwell do not delay admission to hospital. Once treatment has been completed, patients should receive eradication therapy with chlorhexidine wash and mupirocin ointment (11).

**Box 4.**

**PVL-SA**
Consider potential for further spread. Minimise this by addressing the 5Cs and isolating patients if appropriate. Outbreaks require notification via an FMed85. Further guidance is available in JSP 950 leaflet 7-2-9.

**Case Study 4**
An 18-year-old trainee at HMS RALEIGH presents to fresh cases complaining of a painful spot above his lip. It has been present for 24 hours and he noticed some tingling in this area before it developed.

On examination, he has a small cluster of vesicles above his lip. He is otherwise well, but is only three weeks into his training and admits to finding the experience extremely stressful (Figure 3).

**Figure 3. HSV-1 (cold sores) (Source – DermNetNZ)**

**Herpes simplex virus 1 (cold sores)**
Cold sores are caused by the herpes simplex virus 1 (HSV-1). This is a highly contagious infection which is usually contracted in childhood. The primary infection can cause painful swelling and ulceration of the gums and mouth (gingival stomatitis), and usually affects children between the ages of one and five years (6). This may be accompanied by a non-specific systemic illness.

Once resolved, HSV-1 remains present in a dormant state within the sensory nerves supplying the skin. Re-activation can occur at any time, but is often precipitated by stress, minor trauma or sun exposure. The virus spreads along the nerve to the skin where it replicates and causes lesions. Typically, the patient will complain of a tingling sensation lasting several hours, followed by an erosion of closely packed vesicles in the same area. Most patients are clinically well within this period, but systemic symptoms of fever and lymphadenopathy can occur (7).

This condition is usually self-limiting within seven to ten days. If required, treatment is with topical antivirals for mild cases (5% aciclovir), which reduces the duration of the illness and shedding of the virus (12). Oral therapy (also aciclovir) can be given in more severe eruptions, although this is usually only necessary in immunocompromised individuals. If the patient is systemically unwell, then admission to hospital for IV antivirals and further investigation should be considered (12) (Box 5).

**Box 5.**

**Herpes simplex virus 1 (Cold sores)**
This is a highly contagious condition. Patients should be advised to maintain careful hygiene, and avoid close contact with others (e.g. kissing). If eruptions are infrequent, consider asking patients about other factors in their life which could be contributing.
Case Study 5
A 41-year-old Chief Stoker presents with several painless, raised and thickened areas of skin on his fingers. They have been there for “years” and he is untroubled by them. He has been told to attend by his wife who finds them unsightly and doesn’t want to get any herself (Figure 4).

Viral warts
Warts are a benign condition caused by the human papilloma virus (HPV). It is spread by direct contact and occurs when the virus replicates within the epidermis causing it to become raised and thickened. They can occur anywhere on the body. Common warts tend to be caused by HPV 2 and 4; large “cauliflower” type warts by HPV 7, and genital warts by HPV 6 and 8 (7).

Warts of the feet (veruccas) are mostly painless unless they are sited in an area that is frequently irritated. In most cases, patients’ primary concern is that they are unsightly or embarrassing.

Treatment is aimed at removing the visible skin changes. The most commonly used treatments include cryotherapy (freezing) with liquid nitrogen or ethyl chloride spray, or topical treatments (e.g. podophylotoxin or salicylic acid). There is consistent evidence that salicylic acid is more effective, but even this shows only modest therapeutic effect (13). Anecdotally, covering warts with duct tape has been suggested as an alternative treatment, but a review of the evidence for this shows this to be no more effective than placebo (13). Most warts resolve spontaneously over months to years without intervention.

In most cases, warts can be managed in primary care. If patients present with multiple clusters of warts and a history of immunocompromise, or one that puts them at increased risk of HIV (e.g. high risk sexual contact or needlestick injury), then HIV testing and onward referral should be considered (14).

Case Study 6
A 22-year-old female Leading Writer presents complaining of a cluster of small pearly lumps on her thigh. They are painless, and she first noticed them a few days ago. She has just returned from maternity leave and mentions that her daughter had a similar rash at home (Figure 5).

Molluscum contagiosum
This is a common, but harmless infection caused by poxvirus. It is more common in childhood, but can also occur in adulthood. It is spread by direct contact and the virus is highly contagious. Although often seen in the context of a sexually transmitted infection, it can occur from any close contact. It tends to affect patients in warm, moist areas (e.g. limb flexures, groin) and presents as clusters of small pearly papules with a central umbilication (6).

Most infections will resolve spontaneously over months to years and therefore it is advisable to merely reassure the patient rather than treating. In unusual circumstances where treatment is required, several options may be considered. Physical methods include inducing trauma to the lesions by squeezing or piercing them, and cryotherapy (15). No treatment currently exists to kill the virus (Box 6).

Case Study 7
A 24-year-old trainee Marine Engineer presents with pain, erythema and multiple small pustules within his beard area. He has been suffering with this since he came to the UK from Trinidad to start his training and has had to shave on a daily basis. He wonders if it would be possible to be excused shaving for a while (Figure 6).
Shaving rash (sycosis barbae)
This is a form of folliculitis, affecting the hair follicles of the face. It is usually caused by *Staph. aureus* and the patient may have been an asymptomatic carrier for some time (9). It is particularly common in Afro-Caribbean men. Infection occurs following irritation caused by shaving and is then spread further with repeated shaving. Patients will complain of papules and pustules over hair follicles and local irritation in the infected areas. Careful examination of the affected skin should be undertaken to differentiate this condition from pseudo-sycosis barbae which is non-infective localised inflammation caused by ingrowing beard hairs (Figure 7). Swabs should be taken from infected areas and the nose. Treatment aims to stop the active infection and eradicate carriage of *Staph. aureus*. A one-week course of oral antibiotics (e.g. flucloxacillin) combined with no shaving leads to resolution of most cases. If nasal swabs are positive for *Staph. aureus* carriage, then an eradication regime with mupirocin and chlorhexidine wash will help to prevent recurrence. If frequent recurrence does occur, then patients may require long-term antibiotic prophylaxis. If able to, growing a beard or wearing short stubble will also reduce the rate of recurrence by removing the repeated irritation and the potential re-inoculation caused by shaving (7, 9) (Box 7).

Case Study 8
A 52-year-old RFA officer presents to fresh cases complaining of an uncomfortable unilateral rash over his right shoulder. It was preceded by 24 hours of discomfort in the same region and he is also feeling “rather under the weather”. On closer inspection, the area he is indicating is seen to be erythematous, and has clusters of vesicles overlying the areas of redness (Figure 8).

Box 7.
**Shaving rash**
Patients may need to be excused shaving for an extended period of time in order to allow inflammation of the skin to resolve.
Shingles (herpes zoster)
This is a condition caused by varicella zoster virus. It can only occur in adults after the patient has suffered from varicella (chickenpox) which represents the initial infection with the virus. The mechanism of activation is very similar to that of HSV-1 in that the virus remains dormant in a cutaneous nerve root until re-activation. It then spreads along the nerve and replicates within the skin. The breakdown of infected cells results in the eruption of vesicles on the skin in the infected area (9).

Patients usually complain of pain or altered sensation in a specific area for 24-72 hours before any lesions develop. They may also experience systemic symptoms of infection including pyrexia and headaches.

Following this, small vesicles on a red background develop in a typical dermatomal distribution (commonly thoracic and lumbar) over the area supplied by one or two spinal sensory nerves. This is unilateral and does not cross the midline. Most cases resolve completely after two to three weeks. However, many patients experience an ongoing discomfort in the area affected for up to several months after the infection (post-herpetic neuralgia). This typically takes the form of a burning or shooting sensation and can be acutely uncomfortable.

The treatment of shingles is predominantly supportive. Patients should be advised to rest and take regular simple analgesia if required. If the lesions are particularly irritating, a lotion such as Calamine can help to ease the symptoms. If the patient is seen during the prodromal phase of the illness, or within 48 hours of the lesions emerging, then a seven day course of oral anti-virals (aciclovir 800mg 5x/day, famciclovir 500mg TDS, or valaciclovir 1g TDS) can help to shorten the duration of the illness (16) (Box 8).

Box 8.

<table>
<thead>
<tr>
<th>Shingles</th>
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<tr>
<td>Shingles and chickenpox are notifiable diseases and require completion of an FMed85. Whilst most people have chickenpox as children when it presents as a mild disease, infection in adulthood can lead to severe illness. In the event of a case of chickenpox or shingles at sea, all personnel who have not had chickenpox should be identified and advice from an infectious diseases specialist should be sought.</td>
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Case Study 9
A 19-year-old Royal Marine presents having just returned from a holiday in Ibiza. Yesterday evening he noticed multiple patches of pale skin on his back, which are highlighted against the darker, tanned skin. He feels otherwise well (Figure 9).

Figure 9. Pityriasis versicolor (Source – DermNetNZ)

Pityriasis versicolor
This is a relatively common condition in young people. It occurs when naturally occurring skin yeast of the Malassezia genus proliferates more actively than normal within the stratum corneum. Malassezia globosa is the most common cause (17). It frequently occurs in warmer climates and patients will often complain of symptoms after or during a holiday.

It presents as small, red/brown macules with a fine scale on the trunk, neck and limbs. Patients often present after the rash has resolved, leaving characteristic hypo-pigmented macules. These areas will be immediately obvious in dark skinned patients but paler patients may not notice this until they have spent time in the sun and the surrounding skin has tanned.

Pityriasis versicolor is harmless but patients often request treatment as they are self-conscious about its physical appearance. Treatment is with topical anti-fungals for small patches (e.g. clotrimazole for two to three weeks), or washing with ketoconazole shampoo for five days and leaving it in contact with the skin for five minutes before rinsing. Severe cases may require a short course of oral anti-fungals (itraconazole 200mg OD for seven days, or fluconazole 50mg OD for two to four weeks) (17). Following treatment, hypo-pigmented areas can take several months or even years to return to a normal colour.
Case Study 10
On a deployment to the Gulf, a ship’s company is issued with new boots as part of a uniform trial. Over the course of the next few weeks, multiple crew members present to fresh cases complaining of pain and cracking between their toes. They all complain that the new boots are too hot for this climate and are making their feet sweat profusely (Figure 10).

Tinea pedis
This is an extremely common condition within the sea-going population in the authors’ experience, particularly in sailors and Royal Marines deployed to warm climates. Patients with cellulitis often give a history of having suffered with this first. It is caused by dermatophyte fungi, usually Trichophyton rubrum, T. interdigitale or Epidermophyton floccosum. These can exist for several months on floors, mats or materials, and infection occurs when a patient’s foot comes into contact with one of these surfaces (6, 7).

It typically presents in one of two ways. In “athlete’s foot” there is moist scaling and cracking between the toes, most commonly between the 4th and 5th digits. The “moccasin” presentation describes erythematous, annular lesions with a surface scale, typically with an area of central clearing and a well demarcated active edge.

Treatment is with topical anti-fungals (e.g. terbinafine, clotrimazole or miconazole), and advice to keep feet clean and dry. More persistent cases may require oral anti-fungal therapy (e.g. oral terbinafine) (18) (Box 9).

Case Study 11
A 42-year-old Commander presents complaining of thickening and discolouration of his big toenail. It has been present for several months, and appears to have worsened as the nail has grown (Figure 11).

Tinea unguium (onychomycosis)
This fungal infection commonly presents with thickening and crumbling of the nail plate, discolouration and onycholysis. Evidence shows that topical nail paints are ineffective for treatment (19). However, while the motivation for treating is mainly cosmetic, there is a high risk of recurrence and therefore conservative treatment should be considered (19). In exceptional circumstances, where the disease is widespread or there is co-existing foot pathology, oral anti-fungals (terbinafine 250mg once a day for six to twelve weeks for fingernails, and three to six months for toenails) can be used (20). The treatment course is long in duration and the patient requires regular monitoring of their liver function due to possible hepatotoxicity.

Tinea corporis and tinea cruris
Tinea corporis presents as annular, centrally expanding, erythematous, well demarcated, scaly plaques on the trunk (Figure 12). These may be singular or multiple, with or without satellite lesions adjacent to the original plaque.

Although this is generally a mild problem which is mostly considered an irritation, the association with cellulitis means that it should be treated early with topical therapy. Strict advice to wear footwear in communal washing areas on ships and in barrack accommodation can help to reduce spread.

Box 9.
Figure 12. Tinea corporis (Source – Dr A Macdonald)

Figure 13. Tinea cruris (Source – Dr A Macdonald)

*Tinea cruris* occurs in the groin area and is more common in males (Figure 13). The lesions are similar to those of *tinea corporis*. It often has a well demarcated erythematous and active advancing edge. The genitals may be involved. It is thought that this condition is acquired from *tinea pedis*; therefore it is prudent to inspect the feet of any patient who presents.

If possible, all suspected cases should have skin scrapings taken for mycology if there is any doubt of the diagnosis. Use of combined corticosteroid and anti-fungal creams is not recommended, as steroids can exacerbate fungal infections. Treatment for both conditions is as for *tinea pedis* (21).

Management of infective skin conditions in the Armed Forces

It is the experience of the authors that these conditions are common in the sea-going population. The close proximity of accommodation at sea especially lends itself to the spread of SSTIs and presents particular challenges. The question of whether it is in the interest of unit operational capability to restrict the activity of, or even isolate a patient, should be at the forefront of the clinician’s minds in this setting. Similarly, notifiable conditions must be reported via the FMed85 at the earliest opportunity which alerts the medical chain of command to any potential outbreaks (22).

For the Medical Branch Rating or General Duties Medical Officer at sea, help is usually available from ashore (depending on the operational tempo and state of communications). A good history and description of the problem, accompanied by a photograph, will aid this process.

A summary of some of the resources available to help with the diagnosis and management of dermatological conditions is included below (Box 10).

**Box 10.**

<table>
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<tr>
<th>Resources</th>
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<tr>
<td><strong>Clinical Advice</strong> – As per RNTM 124/13 – Provision of Medical and Dental Advice to Afloat and Deployed Units</td>
</tr>
<tr>
<td><strong>Books</strong> - Differential Diagnosis in Dermatology / by Richard Ashton (Surg Capt Rtd.) and Barbara Leppard (on the METSA library scale for all afloat platforms)</td>
</tr>
<tr>
<td><strong>Useful NSNs</strong> – Dermatoscope: 6515-99-851-8501</td>
</tr>
<tr>
<td><strong>JSP950 Leaflet 7-2-2: Communicable disease control (CDC) in the armed forces</strong></td>
</tr>
<tr>
<td><strong>Staphylococcus aureus (PVL-SA) infection in primary care.</strong></td>
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</table>
Conclusion
This article presents some of the conditions commonly seen within the sea-going population. It is not exhaustive, but it is hoped that it serves as a refresher and an initial point of reference for Royal Navy clinicians.

Given the proportion of primary care consultations that relate to dermatology, it is an area which causes frequent uncertainty and confusion. However, applying a logical approach to describing skin lesions and ongoing clinical exposure to them will lead to more confident and accurate diagnosis and management.

References
17. JSP 950, Leaflet 7-2-2. Communicable disease control (CDC) in the armed forces, Aug 2013.

Acknowledgements
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All case studies are made up for illustrative purposes with the inspiration taken from the authors’ experience of practice at sea and shore-side in RFA ARGUS, HMS DARING, HMS ILLUSTRIOUS, HMS EXCELLENT and HMS DRAKE.