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Watch your step! Common reef injuries in Hawaii and treatment options

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PEER REVIEW

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Comments

This is an important research work in which the author has demonstrated the role of prevention of direct contact of non habituated people to coral reef areas. He underlines the presence of different bacterial strains that may cause serious infections if wounds are not immediately managed.

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ABSTRACT

As more people flock to coastal areas such as Hawaii for vacation, many may find themselves coming into contact with coral reef for the first time. Whether it's through snorkeling, swimming, scuba diving, or surfing, the reef can pose a serious danger to anyone not familiar with this delicate life form. While it may appear to be a rock, it is actually a living creature that is home to multiple strains of bacteria. These bacteria can quickly invade injuries sustained from contacting reef, leading to tissue infections ultimately require surgical intervention. In this review, we provide a background on coral reef and its common associated injuries. As there are no evidenced based treatments currently available, anecdotal interventions can be considered.

KEYWORDS

Coral reef, Urchin, Hawaii, Abrasions, Injury

1. Introduction

While it may appear to be simply a rock, coral reef is actually a living organism. It is home to multiple bacterial strains including *Vibrio* spp., *Aeromonas* spp., *Erysipelothrix* spp., *Bacteroides* spp., *Clostridium* spp., *Pseudomonas* spp., and so on[1-3]. When exposed skin comes into contact with coral, coral's exoskeleton often pierces the skin, leaving proteinaceous remnants deep within the tissue that are often invisible to the naked eye[4]. If these remnants were not removed, they can serve as a nidus for severe infections. As a result, reef injuries require prompt medical care to determine if antibiotics are necessary. Injuries may be prevented by avoiding areas with reef, swimming when tides are not strong, and wearing protective swimwear.

2. Background on coral reef

Coral represents a colony of stationary animals that belong to the phylum Cnidaria which also comprises jelly fish, hydras, and sea anemones[5]. By absorbing surrounding calcium in the water, they create a hard exoskeleton, which on average, expands at rates from only 0.3 to 1 cm a year[4].

3. Discussion

Nathanson *et al.* found that from 1998 to 1999 of those sampled surfers, lacerations accounted for 42% of reef injuries and 17% of which were associated with seafloor contact with coral[6]. The type of coral in a region can cause a variety of potential injuries experienced.

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3.1. Abrasions

Divers and snorkelers experience scrapes more often than any other underwater injury from both living coral and bare rock[7]. Abrasions from bare rock are usually self-limited and heal without complication[6]. When abrasions occur from coral, a soft outer layer of the coral is often deposited into the skin of the victim. This will prolong healing time and increase the susceptibility of wounds to infection[4,5]. When injury occurs in an immunocompetent individual, please consider following the steps (Figure 1)[7].

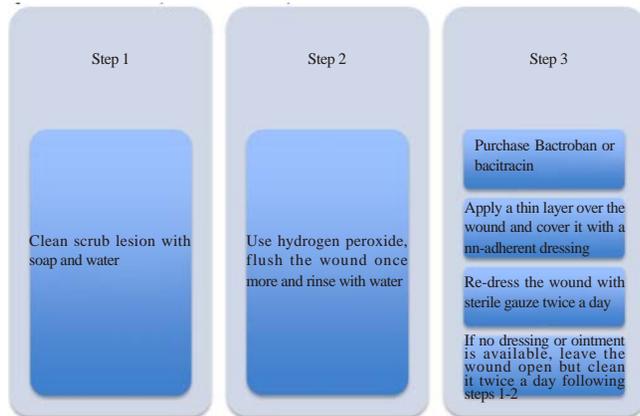


Figure 1. Treatment steps for abrasions experienced from coral reef.

If the wound appears to be infected prompt, medical evaluation should be obtained where treatment consideration can be implemented with a dressing, saturated with sterile saline or an antiseptic solution (1% to 5% povidone-iodine in disinfected water) [7]. A general surgery consultation for optimal wound management may be required along with consideration of antibiotic therapy such as ciprofloxacin to target *Vibrio* species[8-11].

3.2. Urchins

Injuries can occur not only due to direct contact with the coral itself, but from the invertebrates which live in the coral. Injuries appear to peak in the summer months as populations in coastal areas are at peak level[4]. More than half of sea urchin injuries occurred when individuals walking along coral on the shoreline made contact with an urchin that has embedded itself into the reef[3]. If individuals contacted with urchin, the spines would enter the skin and might lead to inflammation, granulomas, and even synovitis if a joint space was involved[4,12].

Spine injuries secondary to contact with sea urchin often present with one of two reactions: immediate and delayed[5]. The initial injury can result in pain, erythema, and swelling from the immediate reaction followed by granulomatous changes from the delayed reaction[4,12]. The initial reaction is likely to release histamine whereas the etiology of the delayed reaction is currently under academic debate[5].

Retained spines should be immediately removed and plain radiographs obtained to assess for joint involvement[4,12]. Embedded spines are not always visualized on radiographs, therefore high clinical suspicion based on history and physical exam is required for adequate treatment and prevention of irreversible joint damage[13-15]. For removal, liquid nitrogen is used to blister the skin which will allow for the spines to be removed using tweezers[12]. If clinical symptoms suggest that the joint capsule has

been penetrated (stiffness, pain with motion), regardless of imaging, definitive treatment may require synovectomy and thorough surgical debridement (with intra-articular steroids) to prevent long-term damage. Antibiotics have not been shown to be beneficial in these select cases[13,14].

4. Complications from these injuries

Due to increased travel to coastal regions, soft and deep tissue infections such as cellulitis and necrotizing fasciitis from *Vibrio* species are becoming more prevalent in the United States[1,16]. If the joint capsules (commonly of the hand) were penetrated by a spine (which may not always appear on radiographic imaging due to poor sensitivity), an immediate hypersensitivity reaction might manifest as periarticular swelling, pain, and stiffness with eventual risk for delayed onset granulomatous synovitis[2,13]. The skin and soft tissue are not the only areas affected by injury. If less common organisms were encountered (such as *Aeromonas* spp., *Erysipelothrix* spp., *Bacteroides* spp., *Clostridium* spp., *Pseudomonas* spp., and rare forms of *Vibrio*), threatening systemic infections would occur[10,17].

5. Prevention

Beach goers should have their tetanus vaccines updated before venturing out to the ocean. When snorkeling, experts recommend wearing a full-body suit (*i.e.* stinger suit) to include gloves to minimize toxin/venom exposure[7]. It is best to avoid days when the waves are strong enough to impair one's ability to swim. When surfing, the use of booties and knowledge of where coral may be located can decrease chances of an unwanted encounter[7]. The "star fish maneuver" commonly implemented by surfers who fall off their surfboard (wipeout) which is a technique to avoid contacting coral reef by spreading all extremities out, called the "star fish maneuver", to prevent one's hands or feet from becoming stuck in or struck by the reef[12].

6. Conclusion

Over 150 different species of coral reef are found in Hawaii, 25% of which are endemic[5,18]. In 2012 alone, over 8 million people visited Hawaii, many of which will find themselves coming to enjoy the beaches or bays[4,19]. As a result, it is important to teach anyone living or visiting here about the dangers that coral reef can pose to individuals. Numerous case reports have been filed regarding surfers and water goers who are injured on coral reef ultimately resulting in severe tissue infections, and often requiring surgery. Many injuries can be prevented with basic preparation. Buoys or floatation aids should be utilized for those who are beginning swimmers however both beginners and advanced alike may benefit from the use of a body suit and gloves when swimming in areas with coral reef. When surfing, avoiding areas known to have high concentrations of coral reef can decrease the risk for injury however if an injury does occur, consider a combination of soap, fresh water, vinegar, and hydrogen peroxide. If a healthcare provider is available, people can take a visit to a doctor when the wound(s) do not improve over a 48-72 h period.

Conflict of interest statement

We declare that we have no conflict of interest.

Comments

Background

Public interest to visit natural area to enjoy beaches and wild life increases continuously. The author indicates that over 8 million people visited Hawaii. The contact of individuals with wildlife may cause different hazard and health threat if special care is not taken. Coral reefs injuries is serious a problem because of the presence different strains of bacteria. Deep researches are needed to target harmful species and to specify efficient antibiotics.

Research frontiers

The present work deals with accidental injuries caused by coral reefs. Such injuries may be a source of serious bacterial infections requiring surgical intervention if they are not treated in the first time. Injuries may be prevented by avoiding areas with reef, swimming when tides are not strong, and wearing protective swimwear that minimizes exposed skin.

Related reports

Nathanson *et al.* found that from 1998 to 1999 of those sampled surfers, lacerations accounted for 42% of reef injuries and 17% of which were associated with seafloor contact with coral.

Innovations and breakthroughs

The principle of this research is simple but it has a good impact on the risk management of human health. Since it shows how the public avoids injuries in contact with coral reefs, this will decrease exposure to bacterial infections.

Applications

This research paper focuses on the prevention of coral reef direct exposure rather than medical treatments of bacterial infections. Maybe antibiotic intake or even surgical interventions are required to heal injuries if the wounds are not cared immediately.

Peer review

This is an important research work in which the author has demonstrated the role of prevention of direct contact with coral reef areas. He underlines the presence of different bacterial strains that may cause serious infections if wounds are not immediately managed.

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