

RESEARCH

Seawater exposure to surgical wounds: an alarming patient perspective

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Abstract

Background There is a wealth of microorganisms that are causative for bone and soft tissue infections. Wounds sustained in, or exposed to, marine environments are unique in regards to the spectrum of bacteria encountered in these environments. The senior author observed a high rate of patient-reported exposure of postoperative surgical wounds to seawater. Anecdotally, this resulted in delayed wound healing or postoperative infection in many patients.

Methods A prospective patient questionnaire was designed to assess the attitudes and beliefs of Gold Coast residents presenting to orthopaedic outpatient clinic towards seawater exposure of surgical wounds. Data was collected over a 3-month period from August–October 2018; 1,000 competent adult patients completed the questionnaire.

Results A total of 29% of the respondents reported to have put their surgical wound in seawater, and 95% of these patients believed that placing their wound in seawater was beneficial to wound healing.

Conclusion This study highlights that, in this population of patients, the overwhelming majority believe that seawater is beneficial to them and to their surgical wounds; we therefore need to be more diligent as healthcare providers about educating our patients in regards to proper wound care.

Keywords infection, seawater

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Introduction

There is a wealth of microorganisms that are causative for bone and soft tissue infections. Wounds sustained in, or exposed to, marine environments are unique in regards to the spectrum of bacteria encountered in these environments¹. Of particular relevance to wound infections, these microorganisms include *Vibrio spp.*, *Aeromonas spp.*, *Shewanella spp.*, *Erysipelothrix rhusiopathiae*, *Mycobacterium marinum*, *Streptococcus iniae* and others². Failure to diagnose and treat these uncommon infections, in particular the highly virulent *Vibrio spp.*, may result in significant morbidity and mortality. Even with prompt diagnosis and aggressive therapy, the case fatality is 30–40%³⁻⁵. The spectrum of clinical manifestations is wide, varying from cases of mild cellulitis to severe life-threatening necrotising fasciitis which, without urgent radical surgery, may lead to sepsis and death⁶.

The Gold Coast, Queensland, Australia has approximately

36km of urbanised ocean beach frontage and a population of 560,000 with approximately 300,000 visitors per year. The beach is an integral part of the social, cultural and economic life of many communities in Australia but also has important physiological, physical and cultural benefits. In a recent survey of Gold Coast residents conducted by the Gold Coast Waterways Authority on the socio-economic uses of Gold Coast waterways, it was found that 91% of respondents agreed or strongly agreed that waterways are a significant reason why they choose to live on the Gold Coast, and 96% of respondents agreed or strongly agreed that waterways contribute to their personal wellbeing⁷.

The senior author observed a high rate of patient-reported exposure of postoperative surgical wounds to seawater. Anecdotally, this resulted in delayed wound healing or postoperative infection in many patients. However, informal discussion with patients demonstrated a commonly held

belief that seawater exposure was beneficial to wound healing; it was therefore sought to quantify the prevalence of this belief in patients attending the outpatient department. It was hypothesised that both the belief in the beneficial effects of seawater, as well as the beneficial exposure of surgical wounds to seawater, would be high in our patient population given their geographic location.

Methods

Ethics approval was obtained from the institutional Human Research and Ethics Committee (LNR/2018/QGC/45216). A prospective patient questionnaire (Appendix 1) was designed to assess the attitudes and beliefs of Gold Coast residents presenting to an orthopaedic outpatient clinic towards seawater exposure of surgical wounds. Data was collected over a 3-month period from August–October 2018; 1,000 competent, adult patients completed the questionnaire.

The questionnaire was completed by most patients within the waiting area of the clinics and was collected by administration staff. It included basic patient demographic information (gender, age, occupation), followed by four questions relating to seawater exposure health benefits, wound healing benefits, the presence of a surgical wound and exposure to seawater, and regular engagement in seawater activities. Following completion of 1,000 questionnaires, data was reviewed.

Results

The mean age of the patients was 48.5 years, with 52% of respondents being male. The reported occupation varied significantly within the cohort. In addition, 44% of patients participate in regular seawater sports, with over half of these patients participating daily or weekly. In total, 92% of patients considered seawater exposure or activity to have health benefits, 7% did not, and 1% were unsure (Figure 1). In particular, 89% of patients considered seawater exposure beneficial to wound healing, while 11% of patients did not consider it beneficial (Figure 2).

Specifically identifying patients who had undergone an operation and the rate of seawater exposure to this surgical

wound, 76% of patients had undergone an operation at the time of the questionnaire, and 29% had exposed their surgical wound to seawater; 95% of this latter group considered it to improve wound healing.

Discussion

The management of postoperative infection remains a substantial challenge for surgeons and the wider healthcare community. A number of variables may contribute to the development of postoperative infection, including operative and non-operative, as well as intrinsic and extrinsic factors. This questionnaire was developed to assess patient opinion and perception of seawater in regards to wound healing and to gain a greater understanding of extrinsic factors which may play a role in morbidity following orthopaedic procedures.

The majority (92%) of patients reported seawater exposure/activity to have health benefits; this was in keeping with previous data published by Gold Coast Waterways Authority⁷ reporting that 91% of residents agree/strongly agree that the waterways are a significant reason why they chose to live on the Gold Coast. Of note, 89% of respondents reported that they believe seawater exposure to be beneficial to wound healing. This firmly-held belief in the community is a concern, particularly when previous studies have highlighted the milieu of bacteria and viruses in seawater^{8,9}. While our study was not designed to assess the microorganisms in seawater, understanding patient opinion is imperative in changing patient perception.

Bacteria and viruses are the most abundant microorganisms in seawater, with 1mL of seawater containing roughly 10⁵–10⁷ bacteria, and 10⁷ viruses^{8,9}. Moreover, wound infections caused by marine bacteria, especially of the genus *Vibrio*, appear to be increasing in frequency and recognition worldwide¹⁰. *Vibrio vulnificus* wound infections are usually acquired by inoculation of contaminated sea water into minor wounds, or by injury to the skin in a marine environment. Although immunocompromised patients are at higher risk, previous studies have described *V. vulnificus*

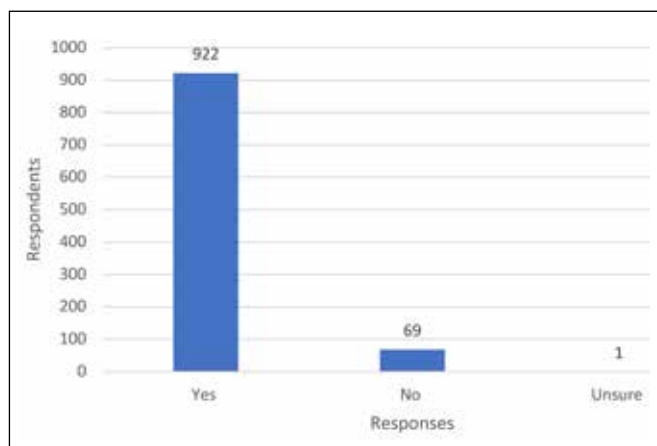


Figure 1. Results from Q1: Do you consider seawater exposure / activities (swimming, surfing etc) to have health benefits?

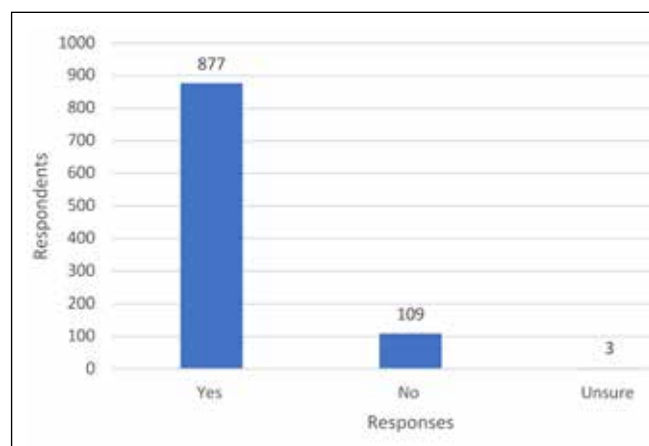


Figure 2. Results from Q2: Do you consider that seawater exposure is beneficial to wound healing?

wound infections in previously healthy individuals^{11,12}. It has even been suggested that *V. vulnificus* persists on intact skin for several hours and is able to infect wounds incurred some time after contact with contaminated water¹³. This is significant as 76% of respondents in our cohort reported having an operation, and 29% admitted to exposing their surgical wound to seawater. It is important to note, however, that this study did not assess the timing from surgery to seawater exposure which is a potential area for future research, nor was it identified if any of the patients who exposed their surgical wound to seawater developed a postoperative infection or required admission.

The majority (95%) of patients reported that they believed exposing their surgical wound to seawater was overall beneficial to wound healing. This is an alarming, strongly-held belief which needs to be challenged by clinicians in order to reduce the risk of patient morbidity; it also highlights an area of communication failure between clinicians and patients.

Limitations

This study gives a global picture of patient perception of attitudes and opinions to the health benefits of seawater and, more specially, to seawater and wound healing. There are, however, several limitations to this study. Firstly, as a patient questionnaire it is subject to recall bias, and the data taken is from a heterogenous patient population. There is also no correlation between wound complications and exposure to seawater, nor did we establish a timeline between date of surgery and seawater exposure. These will be key areas for future research and will be of particular relevance for healthcare providers in coastal communities.

Conclusion

This study highlights that, in this population of patients, the overwhelming majority believe that seawater is beneficial to them and to their surgical wounds; we therefore need to be more diligent as healthcare providers about educating our patients in regards to proper wound care.

Conflict of interest

The authors declare no conflicts of interest.

Ethics statement

An ethics statement is not applicable.

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Appendix 1

Seawater Exposure Patient Questionnaire / Survey

We are seeking to understand the beliefs of our patients regarding seawater exposure, particularly to wounds. This project is to identify what patients at the Gold Coast Hospital think about seawater exposure to wounds. This project involves completion of the survey questions below.

This project / survey is voluntary and you are not under any obligation to participate. Your decision to take part or not to take part will not affect your routine treatment, relationship with your treating team, or relationship with the Gold Coast Hospital and Health Service. Submitting a completed questionnaire/survey is an indication of consent to participate in the project.

Any concerns or complaints about the conduct of this study should be directed to:

HREC Coordinator, Gold Coast University Hospital,
1 Hospital Boulevard, SOUTHPORT QLD 4215
Email: GCHethics@health.qld.gov.au
Phone: (07) 5687 3879

Any complaint will be investigated promptly and you will be informed of the outcome. Please complete the following questions and return this form to the receptionist / nurse / doctor before you leave.

We thank you for your involvement.

Questions

1. Do you consider seawater exposure / activities (swimming, surfing etc) to have health benefits?
Yes / No
2. Do you consider that seawater exposure is beneficial to wound healing?
Yes / No
3. Have you had an operation / surgical wound?
Yes / No
 - a Did you bathe your surgical wound in seawater?
Yes / No
 - i If yes, do you think it helped your wound healing?
Yes / No
 - ii If no, why did you not put your wound into seawater?

4. Do you participate in regular seawater sports?
Yes / No
 - a What sports? (please circle)
*Surfing / Swimming / Bodyboarding /
Jetski / Boating / Waterskiing /
Other: _____*
 - b How often? (please circle)
Daily / Weekly / Monthly