ORIGINAL RESEARCH

Injury and Illness Aboard an Antarctic Cruise Ship

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Objective.—The objective of this study was to determine the incidence and patterns of injury and illness among passengers aboard a cruise ship in Antarctica.

Methods.—Demographic data on passengers were collected for all participants aboard Antarctica cruises on a single ship during the Antarctic summer cruise season of November 2004 through March 2005. Medical logs from each of 11 cruise trips were reviewed for presentation of injuries and illnesses.

Results.—A total of 1057 passengers were included in the study, of which 47.4% were male. The mean age of the passengers was 54 years (± 16.5 years). The overall incidence rate of injury and illness was 21.7 per 1000 person-days. Motion sickness was the most common condition, comprising 42.3% of all medical encounters by the ship physician, followed by infectious diseases (17.2%) and injury (15.0%). The incidence rate of injury increased significantly with age, whereas the incidence rate of motion sickness decreased significantly with age. There was little variation in the incidence and patterns of injury and illness between genders.

Conclusions.—Most illnesses and injuries were due to the motion of the ship, and a large proportion of the passengers aboard the cruise ship in Antarctica were elderly. Injury among older passengers is of special concern.

Key words: Antarctica, cruise, injury, illness

Introduction

During the past 15 years the continent of Antarctica has opened up to tourism on a previously unimaginable scale. With the fall of the Soviet Union, a number of ice-breaking ships that formerly served to supply research and military outposts in the Antarctic region became available for commercial use.¹ These ships offered the opportunity for tourists to not only cruise by the continent of Antarctica but also to set foot upon the continent and its surrounding islands for hiking tours and animal observation. This study aims to determine the incidence and patterns of injury and illness among passengers aboard one of these ships during a recent Antarctic tourism season.

Methods

Demographic data were obtained on all passengers aboard a single ice-strengthened ship participating in any

of 11 Antarctic cruises from November 20, 2004, through March 10, 2005. Excluded from this analysis were 111 passengers in the first cruise of the season extending from November 10 to November 20, 2004, because their records were missing. Demographic data obtained included age, gender, and nation of passport issued. Medical logs were retrospectively reviewed by 3 of the authors (G.H.B., J.D.B., and G.L.) to determine the number and types of chief complaints described upon presentation to the ship physician. All 3 authors agreed upon the current complaint classification system.

All passengers traveled aboard the same ship. All passengers were required to have thorough medical screening examinations and to be cleared for travel to Antarctica by their primary care physicians prior to departure. All passengers were required to bring their own daily medications for the trip. All cruises were 10-day trips except for 1 cruise that was 18 days in length. All cruises departed from the port city of Ushuaia, Argentina, and proceeded through the Drake Passage to the continent of Antarctica, a journey of approximately 600 miles. The ship carried 1 physician for passengers and 1 physician for the crew. The passenger physician was trained in

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Table 1. Incidence rates of complaints by age in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005

Age (y)	Person-days	Complaints, No.	Rate 1000 person-days ⁻¹
<20	213	5	23.5
20–29	750	12	16.0
30–39	1221	36	29.5
40–49	1231	31	25.2
50–59	2103	38	18.1
60–69	3229	65	20.1
70+	1926	45	23.4
Total	10 673	232	21.7

Emergency Medicine or was a generalist with an extensive background in intensive care. The background of the crew physician was unknown. The ship weighed 4251 tons, and had a length of 100 m, a breadth (beam) of 16.24 m, and a draft of 4.65 m. The ship was powered by 2 diesel engines and had a cruising speed of 12 knots.

Complaints were categorized into 1 of 11 groupings: cardiac, endocrine, ear-nose-throat, genitourinary, gastroenterology, infectious, motion sickness, musculoskeletal, neurology/psychiatric, pulmonary, and injury. Musculoskeletal complaints that were traumatic in etiology were listed under the injury classification, while those that were nontraumatic were simply listed in the musculoskeletal category. Complaints were analyzed according to passengers' ages and genders. Incidence rates were calculated by dividing the number of cases by person-days of passengers on the cruise trips. The Johns Hopkins University School of Medicine Institutional Review Board approved this study protocol via exemption.

Results

A total of 1057 passengers participated in these 11 Antarctic polar cruises, and 47.4% were male. The mean passenger age was 54 years, with a standard deviation of 16.5 years and a range of 2 to 89 years. The age composition was similar between males and females. The passengers were an international mix representing over 30 different countries.

There were 232 medical complaints over 10 673 person-days, yielding an overall incidence rate of 21.7 medical complaints per 1000 person-days. The overall incidence rate of injury and illness was similar between genders ($P = .07$) and across age groups (Table 1). Medical complaints covered a variety of conditions (Table 2), with the most common being motion sickness, traumatic

Table 2. Incidence rates of complaints per 1000 person-days by medical condition in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005*

	Frequency, No. (%)	Incidence rate
Motion sickness	96 (42.3)	9.0
Infectious	39 (17.2)	3.7
Injury	34 (15.0)	3.2
Musculoskeletal	16 (7.1)	1.5
Neuro/psych	15 (6.6)	1.4
GI	14 (6.2)	1.3
Pulmonary	8 (3.5)	0.7
ENT	5 (2.2)	0.5
Cardiac	2 (0.9)	0.2
GU	2 (0.9)	0.2
Endocrine	1 (0.4)	0.1
Total	232 (102.3)	21.7

*Neuro/psych indicates neurologic/psychiatric; GI, gastroenteric; ENT, ear-nose-throat; and GU, genitourinary.

injuries, and infectious complaints. The composition of complaints differed significantly by passenger age—passengers aged 60 years and older being more likely to present with injuries, while passengers under age 60 years were more likely to present with motion sickness (Table 3; $P = <.0001$)—but there was no difference in composition of complaints based on gender. The incidence rate of injury increased from 1.4 per 1000 person-days for passengers younger than 40 years to 4.8 per 1000 person-days for passengers aged 60 years or older ($P < .01$; Figure 1). In contrast, the incidence rate of motion sickness decreased from 15.1 per 1000 person-days for passengers younger than 40 years to 4.6 per 1000 person-days for passengers over the age of 60 years ($P < .001$; Figure 2). Of the 34 injuries reported, most were superficial bruises and minor musculoskeletal injuries, although at least one injury was a scalp laceration that required significant suture repair. There was no age or gender variation with infectious complaint presentations.

Table 3. Composition of medical complaints by age (in years) in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005

	<40 y (%)	40–59 y (%)	>60 y (%)
Infectious	7 (13.2)	8 (11.6)	24 (21.8)
Motion sickness	33 (62.3)	39 (56.5)	24 (21.8)
Injury	3 (5.7)	6 (8.7)	25 (22.7)
Other	10 (18.9)	16 (23.2)	37 (33.6)

Table 4. Pattern of complaints by gender in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005*

	<i>Male</i>		<i>Female</i>		<i>Total</i>	
	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>	<i>No.</i>	<i>%</i>
Cardiac	1	1.06	1	0.72	2	0.86
Endocrine	0	0.00	1	0.72	1	0.43
ENT	2	2.13	3	2.17	5	2.16
GU	0	0.00	2	1.45	2	0.86
GI	5	5.32	9	6.52	14	6.03
Infectious	18	19.15	21	15.22	39	16.81
Motion sickness	40	42.55	56	40.58	96	41.38
Musculoskeletal	7	7.45	9	6.52	16	6.90
Neuro/Psych	6	6.38	9	6.52	15	6.47
Pulmonary	3	3.19	5	3.62	8	3.45
Trauma	12	12.77	22	15.94	34	14.66
Total	94	100.00	138	100.00	232	100.00

*ENT indicates ear-nose-throat; GU, genitourinary; GI, gastroenteric; and Neuro/Psych, neurologic/psychiatric.

Discussion

The continent of Antarctica used to be the realm of explorers and researchers. Though the first “tourists” visited Antarctica in 1933,² visitors to the continent were minimal until the recent fall of the Soviet Union. The conversion of research and military vessels into commercial ships that carry tourists at competitive prices has opened the door to Antarctic tourism on a previously unimaginable scale. According to the International Association of Antarctica Tour Operators, during the 2004–05 season, 13 510 tourists participated in Antarctic cruises that included landings on the continent.³

Most of the medical officers on these Antarctic ships are emergency physicians from the United States or Australia.¹ These physicians function as the sole medical officers for the passengers. While there is often a crew physician—typically a Russian doctor who tends to the

Russian crew—there are no nurses or support staff. Physicians embarking upon these Antarctic journeys are responsible for the health of up to 110 passengers, many of whom are elderly and with multiple medical conditions.

Though much more accessible now, Antarctica is still a remote place with little medical support. The history of Antarctica is replete with amazing tales of medical heroics. Prior reports in the medical literature include the handling of an acute abdomen⁴ and a subarachnoid hemorrhage⁵ by medical teams with limited resources and no neurosurgical training during the long Antarctic winter. Though these cruise ships travel during the milder Antarctic summer (November through March) and although procedures for emergency evacuations are in place (the ships are connected to land via satellite phone and radio), there is still the strong possibility that any medical emergency will be handled by the lone medical

Figure 1. Incidence rates of injury (by age) in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005.

Figure 2. Incidence rates of motion sickness (by age) in passengers aboard a cruise ship in Antarctica, November 2004 to March 2005.

officer aboard the ship (with the possible help of the Russian crew physician). Those who travel to this region go at their own risk—both medical officer and passenger alike.

It is interesting to note that in spite of a mostly older passenger demographic, and taking into account a cruise course that travels through the historically rough Drake Passage, only minor injuries and illnesses were reported in this study. Though the elderly had a higher rate of trauma than did the younger cohort, the vast majority of the injuries were mild and were due to falls aboard the ship. No evacuations from the ship were reported and no deaths occurred. In fact, in the approximately 10 years that these cruises have been in existence, the vast majority of trips have been uneventful from a medical perspective. Though there are no hard data regarding the subject, from prior reports and anecdotal evidence it is clear that only a few passengers have needed to be evacuated,¹ and only 1 death has been reported in the medical literature.⁶ However, serious illnesses do occasionally occur—diabetic ketoacidosis, acute myocardial infarction, cardiac arrest—and the medical officer needs to be aware of the risks and must be able to manage these medical emergencies.¹

Motion sickness is by far the most common reason for presentation to the ship physician, and those in the younger age groups seem more prone to this ailment. The reason for the predilection toward the young is not readily apparent, but it is possible that some means of self-selection is taking place. Those who are elderly and have a history of motion sickness at sea are probably less likely to embark upon a trip such as this, or maybe they are more prone to stay in their cabins during rough seas and lie down in a supine position, in which there is a reduced risk of motion sickness.⁷

Many who travel to Antarctica are concerned about the cold and the animals. While the average air temperature during these trips has been documented to be around 0°C,² cases of hypothermia and frostbite are unheard of. Passengers participate in excursions upon land during the day and return to their heated ship, where there are warm food and hot showers, at night. Survival gear is taken to land each time the passengers disembark in the unlikely event that a group gets stranded and cannot get back to their ship before nightfall. Indeed, only 1 case of tourists being stranded has been documented—though a few other incidents have been anecdotally reported—and this was in 1967,² well before the current wave of tourism began.

Passengers are exposed to much wildlife, albeit from safe distances and under the scrutiny of trained expedition staff. During the course of the study passengers had close encounters with multiple species of penguins,

seals, and whales. Though passengers traveled to and from land on inflatable Zodiac boats (Zodiac of North America, Stevensville, MD), there has never been a reported altercation between these boats and any of the animals. Passengers are forbidden to touch or feed the animals and are required to stay away from their nesting and resting areas. Furthermore, upon returning to the ship passengers have their boots scrubbed with soap and water to discourage bacterial and viral spread between wildlife colonies.⁸

This study has several limitations. First, the data are limited to passengers of one single ship. Thus, the results may not be generalizable, because the risk of illness and injury to passengers is likely influenced by the size of the vessel and the route of the trip. Second, medical logs are for administrative purposes and lack uniformity and details. The ship physician usually rotates out at the end of each cruise, and since the ship has no systematic means of documenting illness or injury, medical logs vary in their depth and detail. A third limitation is the lack of definitive medical testing. No lab work or radiographic tests were performed on these cruises. Unlike “tropical” cruise ships that have multiple medical officers, nursing staff, and well-equipped treatment facilities, these Antarctic cruises have more basic provisions. While the medical facilities are well stocked with antibiotics, resuscitation drugs, and basic resuscitation equipment, few have working radiographic ability or laboratory support. Fourth, no follow-up was done on passengers to determine if any illnesses presented after the trip that might have been related to an exposure during the cruise trip. And finally, no comparison was done to determine whether passengers with various preexisting medical conditions presented more or less frequently than other passengers.

Conclusion

The number of tourists to Antarctica has dramatically increased in the past 10 years, providing physicians with opportunities to practice in remote and unusual locations. Medical officers should be aware of the common presentations of illnesses and injuries and the typical demographic with which they will be working. Most illnesses and injuries to passengers aboard the cruise ship under our study are due to the motion of the ship. The passengers are mostly older adults, who are at significantly higher risk of injury than younger passengers. Motion sickness, on the other hand, seems to affect younger passengers excessively. Medical officers must be aware of their limitations in these remote locations. However, when carefully planned and supported, these

trips can provide amazing opportunities to travel throughout Antarctica in relative safety.

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