The Navy's Preventive Medicine Experience in Desert Shield

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With the exception of "Baghdad Belly" (travelers' diarrhea) in the Marine Corps, many of the traditional preventive medicine problems of Naval forces did not occur in the Persian Gulf during the first four months of Desert Shield (August-December 1990). Vector-borne diseases did not cause any known problems and sexually transmitted diseases were almost nonexistent.

Shortly after Desert Shield began, a disease surveillance system was implemented to monitor nine major categories of diseases and injuries seen at all the Navy and Marine Corps medical facilities assigned to the Persian Gulf (Table I). Hospital ships were excluded since shipboard medical problems remained unchanged from those experienced under normal operations. Therefore, the following experiences mostly reflect the medical problems of the Marine Corps. This reporting system worked remarkably well. However, incomplete and delayed reporting and inconsistent use of a standard diarrhea definition posed continuing problems.

Diarrhea

The diarrhea patterns which emerged must be tempered with the fact that diarrhea rates were probably significantly underestimated. There is evidence that only about half the troops with diarrhea actually reported to sick call. The Desert Shield baseline or "normal" diarrhea rate, based upon reported sick call cases, was about 1% or less. When rates climbed above 2% it was considered an epidemic and was investigated actively by Preventive Medicine technicians from that unit. Three patterns have come to light:

(1) Initial traveler's diarrhea: During disembarking, several outbreaks of classic travelers' diarrhea occurred with unit diarrhea rates from 5% to 10%, and an occasional rate as high as 15%.

(2) Elevated or moving baseline. Subsequently, rates fell to an 1% baseline in most units. However, among some units diarrhea rates hovered around 2% to 4%, or after decreasing to baseline (1%) rose back to the 2% to 4% range.

(3) Defined Outbreaks. Isolated outbreaks related to discrete exposures of indigenous food, eg, ingestion of locally harvested shellfish, were observed. (In at least two instances, Marine units had suffered diarrheal outbreaks within 24 hours after parties at which they cooked locally harvested fish or shellfish.)

The diarrhea symptoms changed after the beginning of the deployment. In later cases of diarrhea, symptoms of nausea and vomiting, which were uncommon previously, were observed more frequently. Stool cultures rarely demonstrated bacteria and were negative for rotaviruses and several other viruses. The lack of positive bacterial cultures with the emergence of new symptoms made a viral etiology likely. The epidemiology of many of these cases was not determined, although person-to-person spread was suspected.

Of the organisms causing diarrhea, about 55% of stool cultures grew enterotoxigenic *E. coli* (ETEC), 19% grew shigella and 3% grew salmonella. No rotavirus, giardia or amoebae were isolated. About 44% of the ETEC, 79% of the shigella and one salmonella isolate were resistant to trimethoprim-sulfamethoxazole. About 42% of the ETEC and 84% of the shigella were resistant to tetracycline. No resistance was seen to the quinolone antibiotics, ciprofloxacin or norfloxacin.

Several diarrhea outbreaks affected the working capabilities of some units. In one survey, over 75% of respondents in a single unit had one or more episodes of diarrhea lasting an average of seven days. About 45% endured a moderate or severe limitation of their duties.

The following factors seem to have been related to promoting diarrhea among the troops:

(1) Locally grown ground vegetables obtained from unapproved sources. Investigations revealed that vegetables had been fertilized with human feces or fecally contaminated water. Lettuce was implicated as the major culprit, but several other vegetables were also implicated. Cultures of these vegetables grew several endemic pathogens. Disinfection with the standard weak bleach solution had little or no effect in reducing the diarrhea rate.

(2) The use of contract laborers as food handlers. Supervision of these people was not closely regulated and they presumably did not wash their hands after defecating, thus, inoculating the food they subsequently handled.

Correction of the identified hygiene defects, especially insistence on obtaining food only from approved sources, controlled the initial outbreaks. The causes of the continuing low endemic rate was not clear, but may have been associated with units where sanitation and personal hy-

Table I. *Major Categories of Illness for Naval Personnel in the Persian Gulf (August-December 1990).*

Heat injury	Ophthalmologic
Diarrhea-gastrointestinal	Psychiatric
Dermatologic	Fever of unknown origin
Respiratory	Miscellaneous
Injury non-combat	

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giene practices were poor. The possible factors considered were:

(1) Mechanical flyborne transmission due to inadequate screening around latrines.

(2) Inadequate hand washing facilities, especially around latrines.

In past military deployments it was speculated that person-to-person or flyborne spread was responsible for most long-term diarrhea rates.[1] Fomite spread also may have played a role in Desert Shield, as troops handled common objects such as equipment, or passed out or traded other items, such as Meals-Ready-to-Eat (MREs). Anecdotal reports indicate clusters occurred in tent-mates. In several instances, command emphasis on good sanitary and hygienic practices alleviated the problem.

Local water sources were not implicated as a cause of diarrhea. However, this may have been due to the early emphasis on drinking only potable water, generally provided as bottled water. During initial stages, the importation of US bottled water avoided a problem with contaminated, locally-procured bottled water, as was observed in some previous overseas exercises.[2] There is now evidence that the municipal water supplies near Marine garrisons were generally potable, although rural water often was not. Nevertheless, it remained Marine policy to consider all local water as non-potable, unless specifically approved by US military environmental health authorities.

The age-old problem of road-side vendors and local foodstands existed even in the desert. Several of these were quickly established near US troops. However, none were implicated as causing diarrhea. It was thought prudent to continue to consider all such stands as presenting a very high risk for diarrheal disease.

Antibiotic prophylaxis for diarrhea was not considered desirable because of the number of troops involved and the long-term consequences of long-term prophylaxis.[3,4]

Laboratory studies from the Naval Forward Laboratory (NFL) in Saudi Arabia suggested that ciprofloxacin would be the most effective antibiotic for diarrhea treatment; however, there are no data comparing the effect of trimethoprim-sulfamethoxazole or ciprofloxacin on clinical symptoms. Because the gut levels of antibiotics are quite high, trimethoprim-sulfamethoxazole may have worked better than expected. For this reason, and because supplies of ciprofloxacin were limited, it was suggested that only severe cases of diarrhea (elevated temperature, blood and/or WBC in the stool, severely symptomatic) be treated initially with ciprofloxacin. Other cases were to be treated initially with trimethoprim-sulfamethoxazole, with ciprofloxacin reserved for treatment failures. Mild cases of diarrhea were managed without antibiotics.

Hepatitis

Although hepatitis is often associated with foodborne outbreaks, no hepatitis cases associated with Desert Shield were reported within Marine forces from August to December, 1990. However, with its long incubation period, some cases may have been awaiting symptoms and a few cases may have been asymptomatic. No serologic testing had been done. Nevertheless, because of the diarrhea problem, immune globulin was recommended for all personnel (0.06 ml/kg, up to a maximum of 5 ml for five months' protection). The need for a booster dose remained to be determined, but would probably be influenced by the diarrhea rate at the time the booster dose was due.

CONCLUSIONS

The good control of diarrheal disease, as well as good surveillance data, are very much a function of the stable, non-combat garrison situation that occurred during the August-December timeframe. This static situation allowed maximum effort to be put into appropriate sanitary and personal hygiene practices. However, the fluidity of a combat situation, along with the inevitable deterioration of the health care infrastructure, predicts diarrhea rates will increase with length of combat.

REFERENCES

1. Read W, Vaughan VC, Shakespeare EO: *Report on the origin and spread of typhoid fever in US military camps during the Spanish War of 1898.* Government Printing Office, Washington, DC, 1904.
2. (a) Cunnion SO: Preventive medicine after-action report, Navy Preventive Medicine Unit No. 6—Cobra Gold 1985. (b) Cunnion SO, Merrell B: Preventive medicine after-action report. Navy Preventive Medicine Unit No. 6—Cobra Gold 1986.
3. Arthur JD, Echeverria P, Shanks GD, et al: A comparative study of gastrointestinal infections in United States soldiers receiving doxycyline or mefloquine for malaria prophylaxis. *Am J Trop Med Hyg* **43**:608-613, 1990.
4. Adkins H, Merrel B, O'Rourke T, et al: Travelers' diarrhea among US Navy and Marine Corps personnel during a Western Pacific deployment. *Milit Med* **155**:111-116, 1990. ●