

## Infection Control is One Major Key to Longevity

Girish J Kotwal\* and Sufan Chien

Noveratech, LLC and Department of Surgery, University of Louisville School of Medicine, Louisville, KY 40241, USA

\*Corresponding author: Girish J Kotwal, Noveratech, LLC and Department of Surgery, University of Louisville School of Medicine, Louisville, KY 40241, USA, Tel: +1 502 3277466; E-mail: [gjkotw01@gmail.com](mailto:gjkotw01@gmail.com)

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### Abstract

The leading causes of death among the senior population are similar to those in the general population as a whole; however, several diseases have special features among the elderly. We have studied several people who have lived long lives (i.e., 95+ years), and here we share insights on one or two in particular and what we have learned from them.

### Introduction

We all know that infectious diseases have led to the demise of millions and possibly over a billion humans as well as innumerable birds and animals consumed by humans since the dawn of civilization [1]. Today, the Ebola virus incidence is down to a handful of cases and the deaths due to HIV infection are reduced to those who do not have access to ART or are not compliant. Influenza deaths can be prevented with annual vaccinations, and diseases like smallpox have been eradicated. This progress now allows us to gain insights into infection control.

Vaccines, containment of infected persons, and prophylaxis with antivirals are only some of the ways available for infection control that can contribute to longevity. Infection is one of the most common diseases in older adults, appearing in forms such as pneumonia, abdominal infection, and urinary infection. The most challenging issue in the treatment of older patients is that they do not present typical signs and symptoms. They often present with no fever, cough, shortness of breath or chest pain when they get pneumonia, and the classic signs and symptoms of abdominal or urinary infection are also usually missing [2,3]. This makes diagnosis difficult and hinders prompt and effective treatment.

Vaccines can prevent a number of infections to which the elderly are more susceptible. Therefore, besides ensuring that they have received all the vaccines that are recommended by the CDC in childhood and during adulthood, adults 60 years and older should ensure that they have had the pneumococcal vaccine, the shingles or varicella zoster vaccine, a seasonal influenza vaccine taken annually for the hemisphere they live in and the boosters for tetanus, hepatitis B, and polio [4].

Elderly people who go on cruises in the Caribbean should restrict themselves to consuming bottled water to prevent norovirus infections and any parasitic or enteric bacterial infections. Those living in tropical countries, who do not want to stock up on commercial bottled water, can routinely purify and bottle their own water. One 96-year-old person, JVK we observed, who lives in Mumbai, India, realized the importance of germ-free, clean water after he had a severe case of amoebic dysentery. This long-lived person, for decades, has treated the municipal tap water with alum in a vessel, followed by filtering the water through a hand-woven cotton cloth, boiling it for 1 hour in a

copper vessel (Figure 1), and then letting it cool to room temperature before distributing it into bottles and refrigerating.



Figure 1: Copper vessel used for boiling water.

Elderly people who live in their own homes and use mosquito nets and mosquito repellents and coils are often protected from infection with malaria parasites and dengue and chikungunya virus infection. One of our elderly persons (JVK) from India left his home briefly to get something typed by a typist, who was sitting in a booth in a busy location with open drainage by his side. JVK was bitten by mosquitoes and 10 days later came down with chikungunya virus disease in which the antibodies elicited against the virus causing an autoimmune reaction in the joints. He underwent six months of excruciating pain in the joints, head, and muscles before recovery. Vector control as a means to infection reduction is therefore one key to long life. This person has survived chikungunya infection and has lived for over a decade since then, but the lesson learned for the elderly is always to apply insect repellents when leaving their homes.

Another key element for infection control is keeping homes clear of flies and fleas. This also means ensuring that the home does not have rodents and their pets are kept clean. The 96-year-old person benefited from his father locating to Mumbai in 1937 at the age of 19, from a place close to Mumbai, called Thane. The relocation was done as an urgent response to avoid the plague, as Thane had open sewage and many rats at that time. Bubonic plague would wipe out numerous people in the span of a few days.

Elderly persons living in close proximity to other individuals are also susceptible to infection transmitted by those individuals. Especially susceptible are prison inmates, who are prone to infections. The late president of South Africa, Nelson Mandela, survived until age 95, despite being infected with *Mycobacterium tuberculosis* during his imprisonment. He was treated for tuberculosis, but he continued to have lung ailments for several years after he was released, even though he received the best medical care during the years after his release. Instances are reported of inmates becoming infected with chronic

hepatitis viruses, which shorten their lives. Isolation of infected persons from the uninfected ones within crowded areas would therefore greatly enhance the longevity of those who are not infected. Oral hygiene that includes daily brushing or brushing after every meal with a fluoride containing tooth paste, flossing regularly and getting the teeth cleaned by a hygienist or a dentist at least “twice a year” In seniors who have their original teeth, it is critical to avoid gingivitis, periodontal infections, which can spread to the rest of the body, and ensuring longer life. Those with dentures need to clean the dentures regularly with antiseptics and clean their mouth with a suitable mouth wash that will reduce the infections in the mouth.

Diabetes is another disease with some special features in older people. More than 25% of the U.S. population aged ≥ 65 years has diabetes [5,6]. This disease, especially when it occurs in older adults, is linked to high mortality, reduced functional status, and increased risk of institutionalization. Older adults with diabetes are at substantial risk for both acute and chronic cardiovascular complications. Diabetic foot ulcer (DFU) is a major complication in the elderly and it poses special difficulties for treatment.

All chronic wounds, such as DFUs, are contaminated with bacteria and moulds, and the older adult population tends to have a lower share of closed wounds when compared with younger patients. Several factors make wound healing more complicated in older adults: First, the inflammatory response is delayed in older people. This is the response in the initial phase of wounding when blood vessels dilate to allow white blood cells and nutrients to reach the wound. These responses can significantly slowdown in elderly people. Second, skin elasticity is reduced in older people, which can prevent it from recovering quickly after wounding. Third, diabetes mellitus itself can slow down the wound healing process for several different reasons. Elevated blood sugar narrows blood vessels and hardens the arteries, which both negatively affect wound healing. Furthermore, diabetic neuropathy results in loss of sensation, thereby reducing nutritional feedback and endangering the wound to more damage [7,8].

We propose some future controls that could reduce a significant number of infection-related deaths, especially among elderly patients with diabetes.

- Physical activity: This is one of the most effective ways to improve immune system function and accelerate wound healing in elderly patients.
- Maintaining a healthy weight: This can be challenging, but is rewarded with significant health benefits including lowering the risk for conditions such as diabetes, stroke, high blood pressure, high cholesterol, and heart disease.
- Maintaining good nutrition: Good nutrition is essential for the brain to maintain its function, and it keeps muscles, bones, organs, and other body parts strong for the long haul. Eating vitamin-rich food boosts immunity and fights illness-causing toxins. A proper diet reduces the risk of heart disease, stroke, high blood pressure, type-2 diabetes, bone loss, cancer, and anaemia. Eating sensibly also means consuming fewer calories and more nutrient-dense food, thereby keeping body weight in check.
- Maintaining a healthy lifestyle: Many things can contribute to a more vital lifestyle. Not smoking, eating right, practicing good hygiene, reducing stresses in life, maintaining a positive outlook, staying as active as possible-mentally and physically-socializing with others, getting out in the fresh air, basking in the sun for an appropriate period of time and making sure that the home is safe.

- Taking safety precautions: The elderly should visit their health care providers regularly and recommendations for screening should be followed.

For diabetic wound care, our group has come up with a new strategy that supplies wounded tissues with the most critical nutrition, adenosine triphosphate (ATP) in a form of nano liposome as shown in Figure 2. When used on animal wounds, this new treatment causes new tissue to appear within 24 hours after surgery—a phenomenon never seen or reported in the past. The growth continues and covers the wound in a few days. Furthermore, the growth has a self-limiting feature; therefore it leaves no hypertrophic scarring or any other unusual growth, even two years after treatment.

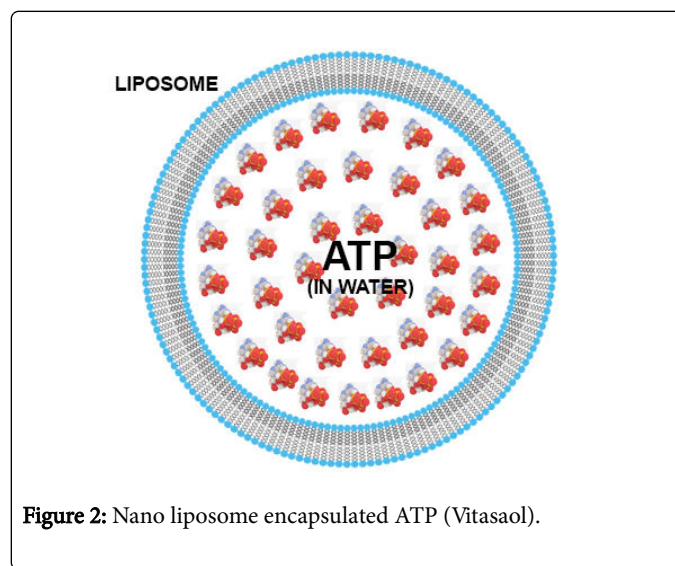


Figure 2: Nano liposome encapsulated ATP (Vitasool).

This type of healing is totally different from the conventional and red blood cells are forming an early provisional matrix, which is then gradually replaced by granulation tissue after a 3-6 day lag time [9,10]. Possible mechanisms by which the healing may occur has been presented in a recent review [10]. We are optimistic that this new healing process can be duplicated in humans, which would give us the potential to revolutionize the classical wound management paradigm, especially for DFUs in the elderly, and save billions of dollars in annual health care costs.

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