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THE CONSEQUENCES OF ANTIMICROBIAL DRUG CONSUMPTION WITHOUT PROPER DIAGNOSIS: SOMALILAND ON VIEW



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Abstract

This paper focuses on the dangers of consuming antimicrobial drugs without a prescription. It also highlights the importance of sensitizing pharmaceutical retailers and the general public against the practice. The use of antimicrobial drugs without a prescription leads to microbial resistance to antibiotics, and the health regulatory bodies need to take up the call to conduct public health education against the harmful practice. Key words: antimicrobial, antibiotic, regulatory bodies, public health.

Introduction

Before the advent of modern medicine, people treated infections using indigenous means such as the use of plant extracts. Most early civilizations had particular means of explaining phenomena like diseases and death¹, with some believing they were forms of punishment from the gods. Modern medicine however uncovered sophisticated processes of identifying disease causing agents such as bacteria.

In the 19th century, many scientists tried to produce effective antibiotics to fight bacterial infections. Scientists such as Alexander Fleming, a British bacteriologist, were trying to identify chemical agents with antibacterial properties. Alexander accidentally identified Penicillin while culturing staphylococci in his clinical laboratory. He had left the culture media uncovered when he discovered that a mould of fungal elements had contaminated the plates – penicillium notatum grew in the plate²

The area in which the contaminant grew had created a clear zone of no bacterial colony. This phenomenon impressed Alexander, who went ahead to prepare a pure culture of the mould. He discovered that the penicillium notatum had produced effective chemicals that inhibit the growth of bacteria even in lower concentrations. This marked the starting point of the golden age in human history, particularly in the treatment and control of infectious diseases³⁴.

Since then, companies around the world have invested in research and have produced advanced drugs to control infectious diseases. This scientific and technological advancement in modern

¹ DJ International Journal of Medical Research, Vol. 1(1) 2016, pp. 1-8. Overview of medicine – its importance and impact

² Alexander Fleming (1881–1955): Discoverer of penicillin. Siang Yong Tan, MD, JD and Yvonne Tatsumura, MA, MD

³ Alexander Fleming, the discoverer of the antibiotic effects of penicillin, doi:

⁴ .3389/frym.2019.00159

human and veterinary medicine became one of the most important improvements to public health, which in turn accelerated population growth⁵.

Bacteria have however been found to have novel mutations in response to antibiotics, potentially leading to the emergence of resistant genes. This phenomenon is called 'Antimicrobial Resistance'. Antimicrobial resistance is a new public health threat that disrupts the effective treatment and control of a wide range of infections caused by bacteria, helminthes, and fungal elements⁶.

Causes of Antimicrobial Resistance

Organisms and genes responsible for antimicrobial resistance (AMR) can easily spread through; contact with other people, contact with animals, food (through animal proteins), water, and the environment, across a country and globally via trade, travel and migration⁷.

Therefore, any conceptualization of non-prescribed intake of antibiotics must go beyond the national scope and take on a global perspective. Before examining the factors that lead to antimicrobial resistance, it is crucial to first differentiate between antimicrobial and antibiotic agents.

Antibiotics: Antibiotics are chemical substances produced by some microorganisms to inhibit the growth of, or even kill other microorganisms

Antimicrobials: Antimicrobials are chemical compounds from biological sources or substances produced by chemical synthesis that destroy (bactericidal) or inhibit the growth (bacteriostatic) of bacteria.

Bacterial resistance to the available drugs is no longer a prediction but a reality that has currently taken root in every corner of the world⁸. This means that patients suffering from drug-resistant

⁵ World population and health in transition. BMJ. 1999 Oct 9; 319(7215): 981–984

⁶ Antimicrobial Drug Resistance: Mechanisms of Drug Resistance, Volume 1. DOI: 10.1007/9783-319-46718-4

⁷ Antimicrobial resistance. Global Report on Surveillance, 2014 World Health Organization

⁸ Veterinary Drug Residues in Meat and Meat Products: Occurrence, Detection and Implications.

bacterial ailments are likely to experience major clinical complications which may sometimes prove fatal.

Antimicrobial resistance (AMR) is a serious global problem caused by the extensive use of antimicrobial drugs in human and veterinary medicine, which puts pressure on the proper selection of drugs. This in turn leads to the emergence and spread of resistant pathogens worldwide. In Somaliland, most people don't know that drugs (antimicrobial agents) given to livestock can lead to serious clinical problems in human medicine. When animals are treated with such drugs, there should be a period of withdrawal – this means the animal products such as meat and milk should not be consumed by humans in the withdrawal period since active ingredients that can create antimicrobial resistance in humans are still present in either meat or milk^{9,10}.

Extensive public information and education should be carried out to sensitize the public, and especially the nomadic pastoralist communities in Somaliland, about the dangers of administering medicine to their animals without prescription or approval from a veterinarian. It is alarming that most farmers in upcountry regions buy medicine for their animals without prescriptions then continue consuming animal products or even selling these products to unsuspecting members of the public.

Mechanisms of antimicrobial resistances

Bacterial pathogens may have intrinsic resistant genes to one or more classes of antimicrobial agents. This can happen by either acquiring resistance by de nova mutational changes to the bacterial genes or through getting resistant genes from other surrounding microorganisms. Infections mainly caused by multi-drug resistant (MDR) microorganisms are highly associated with a higher death rate (mortality rate) compared to susceptible bacteria (bacterial pathogens that cannot grow in the presence of antimicrobial agents). The acquired genes (resistant genes)

DOI: 10.5772/intechopen.83616

⁹ Mechanisms of Antibiotic Resistance. *Microbiol Spectr.* 2016;4(2):

¹⁰ .1128/microbiolspec.VMBF-0016-2015. doi: 10.1128/microbiolspec.VMBF-0016-2015

may help bacteria resist against the effects of drugs by producing enzymes that destroy antimicrobial agents. Antimicrobial resistance mechanisms can be categorized as follows;

- (a) by modification of antimicrobial substances,
- (b) by preventing an antimicrobial drug from reaching its target by decreasing penetration or actively extruding the antimicrobial material,
- (c) by changing or bypassing target sites, and
- (d) through resistance due to global cell adaptive mechanism¹¹

Dangers of Abusing Antibiotics

According to the World Health Organization, self-medication is “the use of drugs to treat self-diagnosed disorders or symptoms, or the intermittent or continued use of a prescribed drug for chronic or recurrent disease or symptoms”. Self-medication is recognized as a leading risk factor for antimicrobial resistance¹²

The abuse of antibiotics has endangered the lives of millions of people around the world, due to the prevalence of life-threatening infectious diseases which were once treatable. These include foodborne diseases, tuberculosis, pneumonia, gonorrhoea and malaria. Methicillin-resistant staphylococcus aureus (MRSA) kills more people around the globe every year alone than bacterial diseases combined. Staphylococcus aureus has the largest potential microbial infection causing superficial skin infection and soft tissue invasive infections including: septicemia, pneumonia, bone and joint infections¹³.

¹¹ Self-medication of antibiotics: investigating practice among university students at the Malaysian National Defense University. DOI <https://doi.org/10.2147/IDR.S203364>

¹² Report Somalia: Medical treatment and medication. LANDINFO –14AUGUST 2014

¹³ Antimicrobial therapy of acute diarrhea: a clinical review, Expert Review of Anti-infective Therapy, 14:2, 193-206, DOI: 10.1586/14787210.2016.1128824

Shigella species and non-typhoidal Salmonella became resistant to fluoroquinolones, while Neisseria gonorrhoea has decreased susceptibility to third generation cephalosporin, which have adverse public health consequences¹⁴.

The abuse of Antibiotics in Somaliland

Self-medication and over-the-counter medication are big challenges in Somaliland. While there is little scientific research and reliable data which sheds light on the extent of the problem, observational experience has proved that non-medical practitioners prescribe drugs to any person who seek medication in their centers, mainly pharmacies. In addition, people often voluntarily buy antibiotics for self-medication purposes.

To make matters worse, there is a lack of public or private control of medications in Somaliland and the pharmaceutical market is controlled by local importers, whereby the only indicators of medicines' usefulness are correct labeling, proper storage during transportation and knowledge of their expiry dates¹⁵

Even with a doctor's prescription of antimicrobial agents, most people do not complete the course of antibiotics. This exacerbates the antimicrobial resistance (AMR) challenge.

The primary therapy for diarrhea, as recommended by the World Health Organization, consists of oral rehydration with sugar and salt solutions. However, since a majority of patients with infectious diarrhea experience a self-limiting case of diarrhea which does not require medication, diagnostic procedures should be done before starting antimicrobial therapy. . In severe cases, especially in patients who are dehydrated, have a high fever, have bloody diarrhea, are advanced in age, have recently taken antibiotics and have underlying immune deficiency, primary evaluation of stool samples for bacterial microbes (Salmonella, Campylobacter, and Shigella species) are required ^[14]. However, in Somaliland, chemists and pharmacies give a course of antibiotics to patients including children without laboratory investigations. This is dangerous

¹⁴ Pneumonia Treatment and Diagnosis, DOI: 10.1513/AnnalsATS.201401-027PL

¹⁵ The Resistance Phenomenon in Microbes and Infectious Disease Vectors: Implications for Human Health and Strategies for Containment: Workshop Summary

because diarrhea can be caused by viral agents, in which case antibiotic use is useless and irrational.

On the other hand, the optimal treatment and management of lung infections depends on rapid and accurate detection of the responsible pathogens, and delay in proper diagnosis causes both morbidity and mortality. Bacteria, viruses, and fungi cause pneumonia. In order to delay excessive inflammatory responses which can cause significant damage to the lung tissue, appropriate medications that inhibit inflammatory responses are required. These include phosphodiesterase 4 (PDE4) which catalyzes cyclic AMP – a decrease in cAMP is associated with diminished T cell cytokine expression and proliferation, inhibition of tumor necrosis factor (TNF) released by monocytes, macrophages and dendritic cells, and the main purpose of PDE4 is to control inflammatory response that may lead to lung damage ^[15]. Since different microbial agents can cause pneumonia, prescribing antibiotics without laboratory investigation is irresponsible medical practice which leads to many preventable deaths especially in children.

Factors contributing to antimicrobial resistance:

The following is a summary of factors that contribute to antimicrobial resistance (AMR):

1. Over-prescription of antimicrobials: - an overdose of drugs can lead to bacterial resistance
2. Patients stopping the course of drugs: - sometimes patients do not complete the entire course of drugs which leads to the pathogens adapting to the medicine, jeopardizing the effectiveness of the medicine. The same drugs become ineffective when prescribed again.
3. Over-use of antibiotics in fishing and livestock farms: - giving over-doses of drugs to farm animals should be followed by an extensive period of withdrawal from consuming their products to prevent the ingestion of active antimicrobial ingredients within their meat and milk.
4. Poor healthcare systems and poor personal hygiene: - when the general healthcare system is ineffective, the prescription and administration of antimicrobial agents are not well regulated and controlled. This will have consequences in the development of antibiotic resistance. Similarly, when individuals do not practice general personal hygiene,

their bodies accumulate harmful pathogens that could be spread to other people, contributing to the overall antibiotic resistance within the population.

5. Lack of newly synthesized drugs to replace the existing ones. It has been long since pharmaceutical companies developed new drugs. Instead, they keep modifying the structure of existing drugs. Modified drugs are a simple target to mutants since the alternative metabolic pathways of developing resistant strains will not take long.

In Somaliland, the most critical factor contributing to antimicrobial resistance (AMR) is the intake of antibiotics without prescription. This is because antibiotics are readily and easily available in pharmacies.

Another factor which public health professionals need to address is the drugs given to livestock, and the lack of proper withdrawal policies and procedures (withdrawal from consuming animal products as documented by the manufacturer or advised a by licensed DVM – doctor of veterinary medicine)

There have been allegations that retailers and wholesalers in the milk value chain add large doses of antibiotics in milk to prevent the overgrowth of bacteria and prolong the shelf-life of milk. This should be investigated and curbed, as it is a major contributor to antimicrobial resistance (AMR).

Another contributor to AMR in Somaliland is the lack of conducting susceptibility testing in clinical bacteriology laboratories. When this test is conducted in the laboratory, the laboratory technician recommends a course of treatment which could be prescribed by the medical professional.

Reducing Antimicrobial Resistance in Somaliland

To reduce the prevalence of AMR in Somaliland, the following steps should be followed:

1. Avoid prescribing antimicrobial agents except when it is necessary
2. Test and confirm which antimicrobial is effective against the existing cause of infectious disease by conduction susceptibility testing in bacteriological laboratories before prescribing a course of treatment. It is estimated that half of all cases for which

antimicrobial drugs are either prescribed or taken by patients are caused by viruses, making the antimicrobials non-beneficial to the patient

3. Prevention of infectious diseases should be prioritized. Without the disease, there will be no need to take drugs¹⁶.

Conclusion

Antimicrobial resistance (AMR) is a global public health issue which can be attributed to the irrational use of antimicrobial drugs. In Somaliland, the intake of antibiotics without a doctor's prescription is one of the biggest contributors to AMR, followed by the overuse of antibiotics in livestock and fish farms. Another major factor for AMR in Somaliland is the lack of conducting Susceptibility testing in clinical bacteriology laboratories. To reduce the prevalence of AMR in Somaliland, doctors should avoid prescribing antibiotics except when absolutely necessary, after requesting susceptibility tests. The prevention of infectious diseases should also take centre stage in the reduction of AMR.

Recommendations

The public health sector should strive to create awareness about the threat of antimicrobial resistance (AMR). Some of the messages that should be amplified are;

1. Only take antimicrobials with the prescription of a certified healthcare professional
2. If you are put on microbials, always complete the entire course without stopping or skipping some doses

Farmers and other stakeholders in the agriculture sector should be advised to use antibiotics only when controlling infectious diseases in their livestock and when necessary. Finally, there should be a national action plan implemented by the government to tackle the antimicrobial resistance

¹⁶ Antimicrobial Resistance and Infection Control (2017) 6:47 DOI 10.1186/s13756-017-0208-x

(AMR) issue. More scientific research on the extent of antimicrobial drugs abuse in the country should also be conducted.

Policy makers should provide;

1. Improved national surveillance of antimicrobial resistant pathogens
2. Regulation of drug quality
3. Education on the dangers of drug abuse.

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