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Editorial

The battle against colistin-resistant *E. coli* and the need for a one health approach

The emergence and spread of antibiotic-resistant bacterial strains pose a significant threat to the global healthcare system. The recent emergence of colistin-resistant *E. coli* strains is cause of concern [1,2]. Colistin, an antibiotic of last resort, has been a vital weapon in our fight against multidrug-resistant bacteria [3]. However, the discovery of bacteria that can evade this last line of defense raises alarm bells.

Urinary tract and bloodstream infections are frequently caused by *E. coli*, which is the most prevalent bacterial agent responsible for both community- and hospital-acquired infections. However, no evidence describing the association between colistin resistance in clinical isolates of *E. coli* and its administration has been provided by any observational studies [4]. Conversely, a correlation was found between colistin use and resistance in livestock agriculture. According to reports by the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC), fattening pigs, calves, broilers, and turkeys is associated with a prevalence of colistin resistance of 0.3%, 0.8%, 1.7%, and 5.7%, respectively [5,6]. China, which is one of the key consumers and producers of colistin worldwide, is trying to drastically decrease its use [7]. In India, which is another consumer of colistin, the colistin resistance in *E. coli* causing hospital-acquired infections was 1.1% [8]. Alarmingly, 70% of *E. coli* isolated from hospital wastewater was resistant to colistin [9].

In Australia and the USA, colistin has never been marketed for livestock animals. The percentage of resistant *E. coli* isolates from Australian patients was 0.39% [10]. In 2019, the clinical prevalence of colistin resistance in North, Central, and South America, Africa, and Asia was 0.3%, 0.3%, 0.3%, 0.19%, and 1.2%, respectively [11].

Colistin has been effective against strains resistant to other antibiotics [12]. However, colistin resistance emerged in China in 2015, primarily driven by a gene known as mobile colistin resistance-1 (mcr-1) [13]. Resistance to colistin occurs through modifications of the Lipopolysaccharide (LPS), resulting in an increased positive charge of the LPS, which reduces its attraction to colistin [14]. [15]. Moreover, the mcr-1 gene can spread to other bacteria through horizontal gene transfer [16]. Some colistin-resistant isolates from livestock animals lacked mcr-1 gene suggesting that there may be other mechanisms contributing to the resistance of these isolate to colistin [17].

The spread of colistin-resistant *E. coli* strains hinders therapeutic options, leading to clinical complications (e.g., sepsis or pneumonia), longer hospital stays, increased healthcare costs, and higher mortality [18].

Moreover, *E. coli* can be found in the intestines of animals and humans, and food. Colistin-resistant *E. coli* in livestock can contaminate meat and other animal products; should they are not handled or cooked properly, great risks to human health can occur [19].

In addition, the administration of more potent antibiotics in both humans and animals for treating colistin-resistant *E. coli* can increase the likelihood of other antibiotic resistance [20].

The emergence of colistin resistance in *E. coli* can be attributed to several factors: Overuse and misuse of antibiotics in both humans [21] and veterinary medicine [22] have played a significant role. The inappropriate use of colistin in agriculture as a growth promoter in livestock has contributed to the selection of resistant strains. Inadequate infection control practices, poor sanitation, and international migration of people and animals have also contributed to the global spread [23]. All of them emphasize the need for a comprehensive, One Health approach focused on antibiotic stewardship in healthcare settings, cautious use in agriculture, and hygiene [24].

Concerted efforts are required: Enhanced surveillance systems to monitor the prevalence [25] and to detect hotspots and outbreaks.

Implementing robust infection control measures in healthcare facilities, livestock production, and food processing industries is vital. Emphasizing hand hygiene, proper sanitation, and responsible waste management can help curtail the spread of resistant bacteria [27–29].

Continued investment in research and development is needed to discover new antibiotics and alternative therapies [30]. Efforts should also focus on developing innovative strategies such as phage therapy and immunotherapy which could improve our armamentarium against antibiotic-resistant bacteria [31–33].

Authors contribution

All authors participated in the drafting and revision of the manuscript and the approval of the final version.

Declaration of competing interest

None.

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