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A Study on Medical Waste Management in Ranchi District with reference to increase in antibiotic resistance in Hospital Sewage

Biological Science

KEYWORDS: Antibiotic resistance, Hospital sewage treatment, Resistant, Biomedical waste, Multidrug resistance bacteria.

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ABSTRACT

Drug resistance microbes have become a havoc in the medical field. Drug resistance in pathogenic microbes is one of the major health issue that the world is facing. Resistance develops as a result of excessive use of drugs to treat even simple medical conditions like fever, common cold etc. Resistant microbes also develop due to unregulated or untreated medical waste. This study intends to detect the presence of antibiotic resistance bacteria in the sewage of major hospitals with reference to waste management process of Ranchi district in Jharkhand.

Introduction

Herbal medicine is the earliest scientific traditional in medical practice, and it remains an important part of medicine to this day in a line descending directly from those distance beginning. In much the same way, the discovery of antimicrobial drug (antibiotic) was one of the most significant medical achievement of the 20th century (Kim L 2013). Overuse of broad spectrum antibiotic hastens the development of antibiotic resistance (Allen *et al,* 2010). Antibacterial are specifically designed to treat bacterial infection (Schwart T *et al,* 2003). Hospital waste contains large number of resistant organism than domestic waste water (Morinigo *et al,* 1990). Such bacteria can be disseminated into the environment through routes such as hospital wastewater (Sharma DR *et al,* 2010, Grabow WO *et al,* 1973, Yang S *et al,* 2004).

However, every organism is bound by the natural process of evolution and so are these microbes again which these antibiotic have been developed (Lee C and Ventola MS, 2015; Rodriguez *et al,* 2009). Since the microbes have simpler genetic structure less life span and a property of exhibiting exponential growth excessive use of any particular antibiotic against a particular pathogen (bacteria, fungus) causes the pathogen to develop resistance against that particular antibiotic in due course of times (Baquero F *et al,* 2008; Canton R 2009). Now the same antibiotic when prescribed will kill all the pathogen sensitive to it (Ganesh *et al,* 2016) but will cease to work again those few pathogen that have been developed resistance against the antibiotic. These few pathogen microbes doesn't allow the disease to be cured by the same antibiotic drug that used to cure the disease.

The study was carried out to screen the antibiotic susceptibility pattern of bacterial isolates from healthcare liquid waste generated from few hospitals of Ranchi and investigate on their role in developing antibiotic resistance.

Material and Method

Sewage Sample collection

Sample from the respective hospitals were collected in sterilized bottles. Spot to collected sewage samples were picked randomly from the listed hospital (Table 1).

Inoculation of sewage samples for assay

Serial dilution of hospital sewage samples were performed up to 10^{-5} dilutions before inoculation with nutrient media. Samples were inoculated with antibiotic containing media incubated at 37^{0}C at overnight. To check the antibiotic resistance, samples plating was performed with proper control to confirm the sterility of experiment.

Table 1: Locations of sample collection.

Hospitals	Geo-location
Kashyap hospital	Latitude: 23.367948, Longitude: 85.326001
Care centre	Latitude: 23.376659, Longitude: 85.332376
Sadar hospital	Latitude: 23.368958, Longitude: 85.326089
Seva sadan hospital	Latitude: 23.371122, Longitude: 85.317173

Table 2: Antibiotic Resistance obtained in following Hospitals.

Sample	Plasmid Found	Culture with Ampicillin	Zone of inhibition
Kashyap Memorial Eye Hospital, Ranchi	No	Ampicillin Resistance (positive)	Negative
Seva Sadan, Ranchi	Yes	Ampicillin Resistance (positive)	Negative
Sadar Hospital, Ranchi	Yes	Ampicillin Resistance (positive)	Negative
Care centre, Ranchi	No	Ampicillin Resistance (negative)	Positive

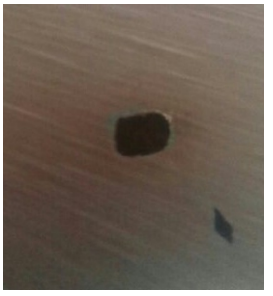

Figure 1: Disk is not inhibiting the growth of bacteria (Control).

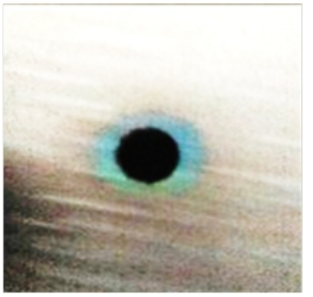

Figure 2: Sensitive bacteria generate inhibition zone in presence of antibiotic (Ampicillin).



Figure 3: Zone of inhibition negative ; Ampicillin resistance positive (Kashyap Eye Memorial Hospital, Ranchi).

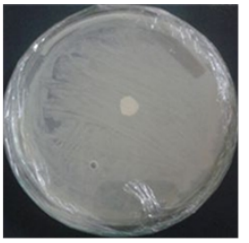

Figure 4: Zone of inhibition negative; Ampicillin resistance positive (Seva Sadan, Ranchi).

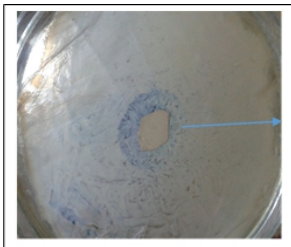

Figure 5: Zone of inhibition negative; Ampicillin resistance ; positive (Sadar Hospital, Ranchi).



Figure 6: Zone of inhibition positive; Ampicillin resistance negative (Care Centre, Lalpur, Ranchi).

Results and Discussion

Samples collected and screened for antibiotic resistance were found to be positive (Table No.2). The control kept along with current test plates confirm the growth of bacteria is not inhibited due to the disk used (Figure 1). With introduction of antibiotics to these disk can able to inhibit the growth of antibiotic sensitive bacteria. Sensitive bacteria generate inhibition zone in presence of antibiotic (Ampicilli) (figure 2). The sample from Kashyap eye memorial hospital showed presence of ampicillin resistance bacteria are present (Figure 3). Similarly samples from Seva Sadan (Figure No.4) and Sadar Hospital (Figure No.5) also indicated the presence of antibiotic resistance bacteria in their waste. These results suggest that Bio medical waste management processes are not proper in some sector of Ranchi District. Antibiotic resistance is found to be absent (Figure No.6) in sample collected from Care centre, Lalpur which may suggest some hospitals follows the Waste Management. As per our enquiry we are unable to verify the same. Health care associated infection can involve some pathogenic bacteria that developed resistance to antibiotic. Globally antibiotic consumption rises due to increase in incomes which leads to more access to antibiotics. Overuse of antibiotics derives the evolution of resistance and incorrectly prescribed antibiotics also contribute to the promotion of resistant bacteria. That is saving lives but also increasing use both appropriate and inappropriate which in turn is driving resistance. Biomedical waste management is receiving greater attention due to recent regulation of the Biomedical Wastes (Management & Handling rules, 1998). The basic principle of underlying wastewater management is the strict limit on the discharge of hazardous liquid into sewers without prior treatment so that living pathogenic organisms are not introduced into the environment. In Ranchi at present no proper government rule of BMW (Bio-Medical Waste) management is prevailing for regulating the hospital waste management.

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