



RESEARCH ARTICLE

OUTBREAK OF MULTI DRUG RESISTANT KLEBSIELLA SP. IN NEONATAL INTENSIVE CARE UNIT IN A TERTIARY CARE HOSPITAL OF WESTERN RAJASTHAN

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ABSTRACT

The incidence of nosocomial infections in the intensive care unit (ICU) is about 2 to 5 times higher than in the general in-patient hospital population. Endemic health-care-associated infection represents a major burden and safety issue for patients in the developing world. Infection with Klebsiella was not very uncommon in the Neonatal Intensive Care Units (NICU) at present. In this study we report an outbreak of MDR Klebsiella infection and its successful control in a tertiary care teaching hospital Jodhpur between November 2016 and January 2017. MDR Klebsiella were isolated and identified conventionally following Clinical and Laboratory Standards Institute (CLSI) guidelines, from various clinical specimens, sent from the NICU. Subsequently, infection control measures including isolation of infected babies, maintenance of hand hygiene, screening for colonization, treatment of infected as well as carrier were implemented in NICU. Demographic data were collected from clinical records. Three (3) care givers were found to be colonized with MDR Klebsiella strains. Antibigram pattern of 20 infected babies matched with the MDR Klebsiella strains isolated from the colonized attendant and nursing staff. Prematurity, low birth weight and top feeding were established risk factors for infection with MDR in this study. Following control measures no such isolate were reported thereafter no case of MDR was reported. MDR outbreak acted as an alarm to the infection control committee of this tertiary care center of Western Rajasthan, India for continuous monitoring and screening for MDR isolates in NICU.

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INTRODUCTION

The incidence of nosocomial infections in the intensive care unit (ICU) is about 2 to 5 times higher than in the general in-patient hospital population. Endemic health-care-associated infection represents a major burden and safety issue for patients in the developing world for epidemiologic purposes, MDROs are defined as microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents. These pathogens are frequently resistant to most available antimicrobial agents. Clinical importance of MDROs are in most instances, MDRO infections have clinical manifestations that are similar to infections caused by susceptible pathogens. However, options for treating patients with these infections are often extremely limited.

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Stay in the hospital for prolonged periods, admission in intensive care units, application of central lines, use of broad spectrum antibiotics, enteral feeding, extremes of age etc are considered as the risk factors for colonization and infection by MDR Klebsiella [Amita Jain, 2008]. In the neonatal intensive care units (NICU), the preterm neonates, critically ill full term babies and infants with congenital birth defects are admitted. They need use of prolonged invasive life supportive measures and antibiotics that increase the probability for acquiring healthcare associated infections [3]. Newborns with immature immune system are particularly liable to get infected with virulent organisms [4]. So, eradicating MDR Klebsiella from NICU was quite an uphill task. Studies regarding incidence of MDR Klebsiella outbreak in NICU, from India is not very common. In this study, we report an outbreak of MDR Klebsiella in NICU in a tertiary care hospital in Jodhpur followed by its control on instituting active surveillance and strict infection control measures.

MATERIALS AND METHODS

The NICU of the hospital is divided into three rooms having capacity of more than 50 beds. There is on an average 12 admissions per day. Nearly, 90% patients in NICU are inborn. Sample Collection- Blood was taken and processed for Bactac Culture, PCT and CRP estimation. Positive Bactac bottles were followed according to Text Book of Microbiology and antibiotic sensitivity testing was done according to CLSI Guidelines.

Outbreak: After detection of these cases of MDR infection by blood culture as on antibiogram all *Klebsiella* Isolates had same antibiogram - showing sensitivity only with cabapenam (Imepenam) and resistance with all other antibiotics. There was increase in *Klebsiella* detection from NICU as compared to previous months (Sept. and October).

Infection control measures: An infection control intervention was started from 2nd week of December after reporting of cluster of 20 cases from NICU in the month of November, to the Hospital Infection control committee as Nodal Officer of ICC was microbiologist only quick intervention was possible. Screening for colonization. Screening for carriage was done on all the departmental health workers (All residents, nursing staff and Guard /care taker on duty) and mothers (40) of the affected babies available at that time and all the neonates admitted at that time in the NICU. Samples were collected from anterior nares and both hands from adult persons with a swab stick moistened with normal saline. Along with these, swabs from perineum and umbilical swabs were also collected from the neonates to detect colonization if present. Environmental cultures were performed from different locations of NICU like baby cot, monitor, ventilator, incubator, water tap, walls of the nursery and air sampling were done. Control measures: NICU infants who were infected were kept in isolation and all positive patients were given IV Meropenam as in our institute this was available in MNDY free of cost to all patients. Outbreak control team was constituted. Appropriate hand hygienic measures, use of gloves, masks and isolation gown were strictly reinforced among all the health care workers in NICU. After proper hand washing with soap and water, Chlorhexidine 4% hand wash was used. Use of Alcohol based hand rub with 1% Chlorhexidine was also reinforced in between attending the patients which was not done previously before the outbreak. The neonates with umbilical sepsis and colonization were given chlorhexidine bath (1: 10 dilution) and were appropriately treated with meropenam antibiotic according to the antibiogram report. The nursing staff, nursing student and attendant who was a nasal carrier was treated with antibiotic Meropenam for 5 days according to antibiogram. Barrier precautions with the use of gowns, masks, gloves were instituted for all direct patient contacts. The medical devices and baby cots, incubators, etc. were disinfected with 2% hypochlorite solution after taking swabs. The floor was swabbed with lysol thrice daily instead of twice a day as was done earlier.

RESULTS

Of the 144 neonates, 42 developed septicemia with the same MDR strain as compared by antibiogram report. Three of them died - may be because of extreme prematurity and very low birth weight. There was death in another neonate with MDR

infection due to respiratory distress syndrome in a case of prematurity. Interestingly, the blood culture report showed MDR isolate with the same sensitivity pattern in both these neonates (Table 1). During active surveillance MDR was isolated from 1 nursing staff and 2 attendants from their hands. The sensitivity pattern of 3 infected neonates matched with that of the attendant in which phenotypically same *Klebsiella* was detected from her hand and nasal samples. The pattern of sensitivity of 2 neonates matched with that of 1 nursing staff and 1 neonate matched with the hand swab of the no.1 attendant (Table 2). The source of infection of the rest neonates (including the baby with eye infection) could not be determined. None of the mothers were carriers for MDR. Colonization with MDR was detected in 9 neonates from umbilicus. Their sensitivity pattern was similar to that of the nursing staff and the attendants. MDR *Klebsiella* incidence preceding outbreak 1 month preceding the outbreak, the incidence of *Klebsiella* infection was 5 CASES ----but none was MDR (Table 3).

Table 1. Laboratory culture positive infections during the study period

ISOLATE DURING STUDY PERIOD FROM NICU									
S. No.	Month	Klebsiella			Staph. aureus	Other GPC	Candida	Sterile	Total
		MDR	Non MDR	Other GNB					
1	Sep. 16	0	0	2	0	1	2	1	6
2	Oct. 16	1	4	2	3	1	8	2	21
3	Nov. 16	2	7	4	0	3	7	7	30
4	Dec. 16	36	6	2	2	10	3	18	77
5	Jan. 17	3	1	1	1	1	1	2	10

MDR *Klebsiella* isolate

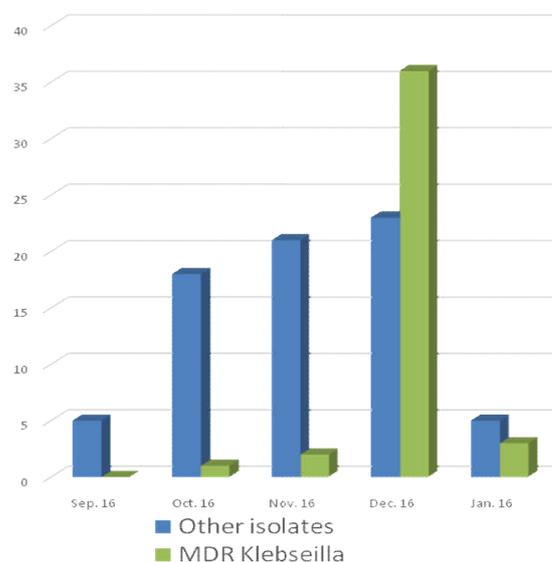


Table 2. Laboratory culture positive infections

ISOLATES FROM HEALTH CARE WORKER AND ATTENDERS								
S. No.		Klebsiella			Staph. aureus	Other Candida	Total	
		MDR	Non MDR	Other GNB				
1	Health care worker	1	2	2	1	11	0	17
2	Attender	0	0	3	3	31	3	40

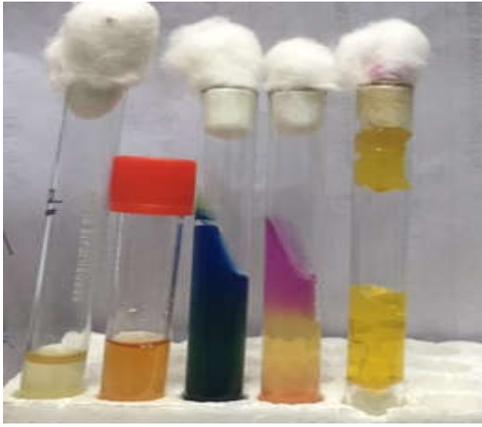


Figure 1. Showing biochemical reactions of Klebsiella Isolates



Figure 2. Lactose Fermenter Colonies of Klebsiella on MC Agar culture plate

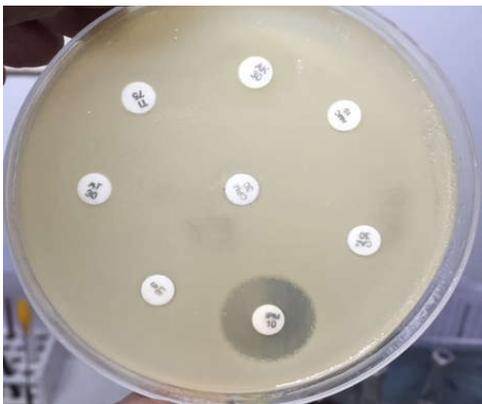


Figure 3. Antibiogram of MDR Klebsiella –Imepenam sensitive

MDR Klebsiella incidence at the time of outbreak

The MDR Klebsiella incidence at the time of outbreak was 19%. The infected and colonized individuals were followed up with negative culture reports after adequate treatment. MDR Klebsiella incidence after the outbreak--- No case was detected. Follow up was done and duty of staff was changed. After implementing the intervention strategy to control the MDR Klebsiella infection, active surveillance was done for detection of infection and colonization for two months post outbreak.

The MDR Klebsiella incidence was found to be 1.6% (1 MDR infection out of total 63 cases of infective etiology in next two months) of the total cases caused by other organisms.

Mother Feeding area in NICU



Functioning NICU



There were 2 colonized neonates during this period. The last case of MDR Klebsiella colonization was detected at the end of December. Focused surveillance was continued till Feb., 2017 and two cases of MDR Klebsiella infection along with Candida co infection was identified during this period out of which one passed away and second responded to IV Voreconazole treatment. When potential risk factors for developing MDR were considered, low birth weight, multiple pregnancies and Ryle's tube feeding appeared as significant risk factors for developing MDR Klebsiella infection (Table 4).

DISCUSSION

Hospital associated infection (HAI) are infections that is acquired in a hospital or health care facility i.e. the infection was not present or incubating at the time of admission. The MDR Klebsiella strain was present in NICU as was evident from the infections before the outbreak. If proper intervention was done at that time, this outbreak may not have occurred. One of the sources may be the Health care personnel whose antibiogram pattern was found to be similar to that of the infected neonates. Similar pattern of outbreak in NICU from the colonized care givers were reported by others also. Immediate intervention was undertaken in the form of isolation, hygienic measures regarding hand washing, active surveillance, proper and strict treatment of the infected, colonized and carriers. This may have led to the control of the outbreak and reduction in the rates of MDR Klebsiella, infection and blood stream infection. This study confirmed prematurity and low birth weight of the neonates as significant

risk factors for MDR *Klebsiella* found by other workers. Most of the patients had intra venous lines, and Ryle's tube feeding, which were all potential sources of infection as reported in other studies also. This further led to the exposure of the neonates to the healthcare personnel for prolonged periods; thereby increasing the chance of contracting infection. The neonates, who required prolonged stay in the NICU because of severity of their disease, prematurity etc., had more chance of contracting infection and chance of colonization. The patient and health care personnel ratio was also low in this set up, so that sometimes in case of emergency, there was a tendency for avoiding hand washing in between patients. This might be a way of introducing outbreak strain to the sick neonates. Sometimes, there is also overcrowding leading to the placement of two neonates, in the same bed like the twins in this study causing cross infection. The time period between taking a swab and receipt of the result can also be a factor in helping the spread of infection from the unknown MDR *Klebsiella* positive infected / colonized neonate, thus acting as a source for outbreak in NICU. Regarding the sensitivity pattern, Imepenam was 100% sensitive with all *Klebsiella* with all isolates.

Three patients died. One of them had respiratory distress, another was associated with very low birth weight and prematurity and third by *Candida* co infection along with low birth weight and prematurity. MDR *Klebsiella* could not be implicated as the sole cause of death. As MDR *Klebsiella* outbreak in NICU is very dangerous, proper and intensive infection control measures are required for proper control of infections in NICU. Along with this, detection of recently colonized babies should be continued for prevention of this outbreak. Figure 1,2,3 – Showing antibiotic sensitivity test result showing sensitivity with Imepenam and Culture plate showing Lactose Fermenter colonies of *Klebsiella* and Biochemical test for *Klebsiella* Identification in Laboratory. Biochemical test for *Klebsiella* Identification in Laboratory. Culture plate showing Lactose Fermenter colonies of *Klebsiella*. Figure – Showing antibiotic sensitivity test result showing sensitivity with Imepenam and Culture plate showing Lactose Fermenter colonies of *Klebsiella* and Biochemical test for *Klebsiella* Identification in Laboratory

Conclusion

The MDR *Klebsiella* strains were present in the NICU and went unrecognized till the outbreak occurred, it could be prevented by: Hand washing, Personal protective equipment [PPE], Preventing/managing sharps injuries, Aseptic technique, Isolation of positive cases and health care workers. In NICU, Linen handling and disposal policy, Waste disposal policy, management of Spillages of body fluids and Risk management/assessment is mandatory as. The increased susceptibility of the premature and very low birth weight babies to infection and presence of carriers of MDR in NICU was responsible for the outbreak. The major intervention in the form of maintenance of hand hygiene with its strict compliance among the health care personnel, detection of carriers, and active surveillance of colonized neonates frequently combined with treatment has been successful in controlling such outbreaks.

The health care givers should be screened at intervals for early detection and treatment of carriers. A continued education of health care personnel is also important in reducing the incidence of MDR, so that outbreaks do not occur. Potential risk factors for MDR infection

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