

STUDYING THE POSSIBILITY OF TRANSMISSION OF *KLEBSIELLA PNEUMONIAE* FROM MOTHER TO FETUS VIA THE PLACENTA

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ABSTRACT

Back ground: There are many ways of transmitting the opportunistic pathogen *K. pneumoniae* to the host, but the possibility of the bacteria being transmitted via the placenta still not fully understood. **Objectives:** investigation the ability of *K. pneumoniae* to transmit through placenta. **Methods:** A blood sample from a two days age female patient, was cultured on blood and MacConkey agar, and the bacteria were diagnosed and their sensitivity was tested using Vitek2 compact system. In order to determine the source of the bacteria, a swab from the hospital lobby, and both blood and urine samples from the mother have been taken. **Results:** The results of the diagnosis and susceptibility testing of the patient showed that the isolated bacteria were multi-drug resistant *Klebsiella pneumoniae*. while susceptible strains of *K. pneumoniae* were also isolated from both the hospital lobby and the mother's urine sample. However, the bacteria isolated from the mother's blood sample yielded the same results as the sensitivity test for the bacteria isolated from the patient. **Conclusion:** There is a possibility of transmission of *Klebsiella pneumoniae* bacteria through the placenta by ascending from the vagina and cervix.

KEYWORDS: *K. pneumonia*, Multidrug resistance, Placenta, horizontal transmission, ascending.

INTRODUCTION

Klebsiella pneumoniae one species of the family Enterobacteraceae. They are one of the most important species that cause nosocomial infections. It constitutes about 11.8% of hospital acquired infections (HAI) in the whole world.^[1] In Iraq *K. pneumoniae* responsible for 7.6% of HAI.^[2] it also considered the second causative species of bloodstream infections.^[3] *K. pneumoniae* causes various infection, such as pneumonia and urinary tract infection, in addition to infection of wounds and burns.^[4] *K. pneumoniae* like other bacteria can be transmit by direct or indirect ways from infected patient through skin contact or with environmentally contaminated surfaces and/or objects.^[5] Most studies indicate that *K. pneumoniae* has a role in the occurrence of Acute chorioamnionitis (AC) when it invades placenta and causes its inflammation, which often leads to abortion.^[6] due to preterm premature rupture of membranes (PPROM) leading to preterm delivery, respiratory distress, sepsis, and occasionally fetal death.^[7] the present article a case for neonatal female with multidrug resistance *K. pneumoniae* isolated from

its blood and causes respiratory disorder. The aim of the study a to investigate the possibility of *K. pneumonia* transmission via placenta and cause infection.

CASE STUDY REPORT

one day old new born female was admitted to Respiratory Care Unit (RCU) in the Maternity and Children educational hospital in al Diwaniyah province at the 31of October \2024. on admission the patient's temperature was 37.8°C, the child was born (normal labor) with Heart septal defect. The mother was suffering from unknown origin moderate fever, A blood samples from both the mother and the child were cultured on the MacConkey and blood agar media, a urine sample for the mother and swabs from the birth hall and the recovery hall in the hospital had been take for the purpose of culture.

METHODS

Samples: In this study, a blood sample was taken from both the fetus and the mother. As for the urine sample, it was taken only from the mother. Swabs were also taken

from various places in the hospital, including the delivery room, the premature infant's incubator, and the rest lounge, where the mother and baby stayed for a period after birth.

Samples cultivation: The blood and urine samples and swabs taken were cultured on blood and MacConkey media and placed in the incubator for 24 hours at 37°C.

Bacterial Identification: The growing bacterial species were diagnosed through gram staining and a set of biological tests, such as IMViC test and conducting a Vitek ID test to reveal the identity of the bacteria.

Antibiotic sensitivity testing: A vitek 2 compact system (BioMerix \France) conducted for antibiotic sensitivity testing to *K pneumonia* isolated from the blood of a

newborn baby, the mother's blood and urine, in addition to *Klebsiella* isolates from swabs taken from the hospital, to antibiotics was tested.

RESULTS AND DISCUSSION

1- Vitek Results for identification of bacterial infection

The Vitek system was used to diagnose the growing bacteria that isolated from blood samples, urine, and swabs taken from the hospital. Several species of Gram-negative and positive bacteria were diagnosed. the blood sample taken from the child showed the presence of *Klebsiella pneumoniae* .as shown in table 1 below.

Table 1: The most isolated bacterial species from the samples in the field of study.

SAMPLE	BACTERIAL SPECIES
BLOOD FROM NEW BORN BABY	<i>K. pneumoniae</i>
BLOOD FROM THE MOTHER	<i>K. pneumoniae</i> , <i>E. coli</i> , <i>pseudomonas aeruginosa</i>
URINE SAMPLE FROM THE MOTHER	<i>K. pneumoniae</i> , <i>Proteus mirabilis</i> , <i>E.coli</i>
SWABS FROM THE HOSPITAL	<i>K. pneumoniae</i> , <i>Acinetobacter baumannii</i>

The presence of the bacterial species referred to in the table above is common, as they are among the most important types associated with hospital infections. Therefore, antibiotic sensitivity test is an important step to find out the source of transmission of bacteria to the neonatal.

2- Antibiotic sensitivity test results (AST)

Antibiotic sensitivity test to the *K. pneumoniae* that isolated from the samples under study was conducted using the Vitek system and according to the CLSI \ 2024, as the results are shown in the following Table 2.

Table 2: Antibiotic sensitivity test results.

ANTIBIOTIC MIC	NEONATE	MOTHER		HOSPITAL SWABS
		Blood	Urine	
TICRACILLIN > = 128	R	R	R	R
TICRACILLIN\ CLAVULANIC ACID 16	I	I	S	S
PIPERACILLIN > = 128	R	R	R	S
PIPERACILLIN \ TAZOBATAM 8	R	I	S	S
CEFTAZIDIME 8	R	R	I	I
CEFEPIME < = 1	R	R	S	S
AZTREONAM 4	R	R	S	S
IMIPENEM < = 0.25	R	R	S	S
MEROPENEM < = 0.25	R	R	S	S
AMIKACIN 4	R	R	S	S
GENTAMICIN < = 1	R	R	S	S
TOBRAMYCIN > = 16	R	R	R	R
CIPROFLOXACIN 1	R	R	S	I
MINOCYCLINE 8	R	R	I	S
TRIMETHIOPRIM\ SULFAMETHOXAZOLE > = 320	R	I	S	S

The table above shows high similarity between *K. pneumoniae* isolated from a newborn baby and mothers blood sample which were resist to all types of antibiotics used except Ticracillin\ clavulanic acid which gave intermediate results, while the mother's urine sample was sensitive to most of the antibiotics used and resistant only to Ticracillin, Piperacillin and Tobramycin. But *K. pneumoniae* isolated from hospitals swabs were resistant to Ticracillin and Tobramycin and sensitive to the other used antimicrobial agents. The above results showed that

K. pneumoniae. has been transmitted from the mother through placenta. Especially since the mother was suffering from unknown origin fever at admission. The placenta is a highly specialized organ designed to protect the fetus while facilitating nutrient and gas exchange. However, some bacteria have evolved strategies to breach this barrier. Like Hematogenous Spread (Bloodborne Pathogens): Bacteria in the maternal bloodstream can infect the placenta if they can adhere to and invade trophoblast cells.^[8] For example, *Listeria*

monocytogenes which uses internalins (InlA and InlB) to bind to placental cadherins, enabling invasion and *Treponema pallidum* which can traverse tissues due to its motility and evade immune responses. Many bacterial species take Ascending Infection from the Genital Tract mechanism where pathogens can ascend from the vagina and cervix, by pass the cervical mucus plug, and infect the fetal membranes (chorioamnionitis). This route is more common in gram-negative bacteria like *Escherichia coli*.^[9] The infection often results in inflammation that compromises the placental barrier. In the present case it seems that the opportunistic pathogen *K. pneumonia* has transferred from the mother to the neonate by vaginal ascending. Since the case was transferred to the hospital after labor, there was no examination of the placenta and observation of whether it was infected with *K. pneumonia*.

Since 2005, only three cases have been reported about the possibility of *Klebsiella pneumoniae* being transmitted to the fetus and causing the death of the fetus after birth.^[6] The first was an instance of IUFD (Intrauterine fetal demise) at 18 weeks of pregnancy. Acute villitis and AC were discovered in the placenta. *K. pneumoniae* was identified from placental cultures and maternal blood. No fetal autopsy was conducted. The mother's elevated temperature (41 °C) and foul-smelling vaginal discharge led to her hospital admission. Additionally, the woman had been experiencing vaginal bleeding for a day before admission.^[10] The second case was recorded at 2006, for a 15-week spontaneous miscarriage. The mother experienced mild vaginal bleeding and a potential miscarriage during the 12th week of pregnancy, but she recovered fully after remaining in bed. However, the US revealed IUFD in the fifteenth week. Although there was no disease seen in the placenta, placental cultures tested positive for *K. pneumoniae*. Additionally, the fetal autopsy revealed no signs of inflammation or infection. However, the authors ascribed the fetal death to a placental microbiological detection of *K. pneumoniae*. The husband most likely infected his wife with *K. pneumoniae* and had prostatitis.^[11] The third was reported by Torabi *et al* at 2008. when *K. pneumoniae* was discovered in fetal blood and lung tissue cultures, PPRM and IUFD occurred at 20 weeks of gestation as a result of an intrauterine infection. Chorionic vasculitis, funisitis, and severe AC were observed in placental pathology. Clusters of bacteria and neutrophils were found in the gastrointestinal system lumen and lungs during fetal autopsy. Despite having PPRM, the patient had no history of vaginal bleeding and no fever either before or during her hospital stay. Additionally, she denied having urinary or respiratory illnesses during her pregnancy.^[12] The pathogenicity of *K. pneumonia* mediated by high variety of virulence factors controlled by different virulence genes. Which give it the ability to invade the most fortified parts of the body. aided by antimicrobial resistant genes. This is the first case reported in Iraq. study the ability of *K. pneumonia* to pass through placenta without causing abortion.

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