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STUDY OF ROUTS OF ETIOLOGIC BACTERIA CAUSING NEONATAL INFECTIONS IN AL-HILLA CITY, IRAQ

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ABSTRACT : A total of 666 samples were collected from different sites of neonates, mothers and hospital environment. Out of these, 490 samples were collected from both sexes neonates who ranged in age between one to ninety days that were admitted to the Preterm Unit and Neonatal Intensive Care Unit (NICU) in Babylon Hospital for Pediatric and Gynecology in Al – Hilla city, Iraq, during the period from March 2012 to February 2013. Neonatal samples included Blood, Urine, CerebroSpinal Fluid and swabs from many different sources. A total of 74 samples were collected from pregnant women and mothers in delivery room. Moreover, 102 samples were collected from hospital environment.A total of 510 bacterial isolates were identified, Gram negative bacteria were the more frequent isolates 284(56%) than Gram positive 226(44%).

Routs of etiologic bacteria of neonatal infections included Intrautrin, Intrapartum and Nosocomial Infections. Transmission from mother was the most common rout with 56 isolates.

Key words : Neonatal infections, routs, bacteria, Al-Hilla.

INTRODUCTION

Neonatal infection is a term used to describe any microbial infection being documented in the first month of life. Despite the considerable progress in hygiene strategies, introduction of new and potent antimicrobial agents and advanced measures for diagnosis and treatment, neonatal infection remains one of the main causes of neonatal mortality and morbidity due to the vulnerability of neonates for infection because their humoral and cellular defence mechanisms are inadequately developed, in addition, the signs and symptoms of infectins may be diffucult to distinguishespecially in in preterm neonates (Klinger *et al*, 2000; Shahsanam *et al,* 2008).

Routs of etiologic bacteria of neonatal infections included Intrautrin, Intrapartum and Nosocomial Infections.

Throughout pregnancy and until the membranes rupture, the fetus is relatively protected from the microbial flora and pathogens of the mother by the chorioamniotic membranes, the placenta and poorly understood antibacterial factors in amniotic fluid. However, there are many ways that infectious agents can reach the fetus or neonate to cause infection including: intrauterine infections, intrapartum infections and postpartum infections (Goldenberg, 2003; Westover and Moss, 2012; Klein, 2001).

Intrauterine (Antenatal) Infections

Bacterial infections within the uterus can occur in the following sites (Fig. 1): (i) between the maternal tissues and the fetal membranes, i.e., within the choriodecidual space (choriodeciduitis), (ii) within the fetal membranes, i.e., the amnion and chorion, which is called chorioamnionitis, (iii) within the amniotic fluid (amnionitis), (iv) within the umbilical cord of the fetus (funisitis), (v) rarely, within the placenta: placentitis, villitis and others (Galinsky *et al*, 2013; Goldenberg *et al*, 2000).

Intrauterine infection is one of the most common antecedents of premature birth (Goldenberg, 2003) and it is thought to play a major role in the pathogenesis of fetal lung injury, aberrant lung development and the resulting neonatal and adult chronic lung disease (Lee *et al*, 2008; Lahra *et al*, 2009).

Intrauterine infection refers to the vertical transmission of pathogens and reach the developing fetus by many pathways which have been clearly summarized as ascending and descending pathway.

Ascending pathway is represented by the ascending infection from female genital tract (vagina and/or cervix)

into the uterus and consequently, into the fetus. Ascending infection is the most common route of EOS in neonates (Kaufman and Fairchild, 2004; Goldenberg *et al*, 2000; Goncalves *et al*, 2002). Once infected amniotic fluid is aspirated or swallowed by the fetus, the pathogens may penetrate through immature mucosal barriers resulting in pneumonia or bacteremia, or may penetrate the blood-brain barrier leading to meningitis. In addition, amnionitis have been implicated as a major cause of pre-rupture of membranes and consequently, of premature birth (Schrag *et al*, 2002; Westover and Moss, 2012; Kim *et al*, 2009).

In many cases, pathogens may penetrate the placental membranes and cause changes in the placenta that interfere with it's capacity to deliver oxygen and nutrients to the fetus or to eliminate wastes and carbon dioxide, consequently, effect on brain development by reducing the normal blood flow and oxygenation of the brain and may also cause abnormal fetal heart rate patterns (De-Man *et al*, 2000).

If the pathogens invade the umbilical cord, they will cause funisitis and lead to the abortion and in severe cases these pathogens may cause necrotizing funisitis, which is a very severe form of funisitis in which the tissue that makes-up the umbilical cord starts to die (Wu and Colford, 2000). Intrauterine infection is most commonly presents as chorioamnionitis, usually caused by bacteria (Goldenberg *et al*, 2000).

Traditionally, the microorganisms most commonly associated with infection of the amniotic cavity are *Ureaplasma urealyticum*, *Ureaplasma parvum*, *Mycoplasma hominis* and *Gardnerella vaginalis* (DiGiulio *et al*, 2010).

Descending pathway is represented by transplasental (hematologic) infection, in which, the pathogens transsmite directly from the maternal blood stream into the fetus (De-Man *et al*, 2000). This infection appears to be the most important because it is used by most viruses and parasites (Enright and Prober, 2002; Goldenberg, 2003).

Intrapartum (Perinatal) Infections

During birth, fetus is exposed to maternal blood, body fluids and maternal genital tract. Because of this, blood-borne microorganisms, sexually transmitted organismsand normal flora of the genito-urinary tractare commonly seen in infections of neonatal period (Goldenberg, 2003; CDC, 2012). The majority of infants probably do not encounter bacteria until they reach the vagina where initial colonization usually takes place with the microflora of the birth canal and will play an important role in development of Neonatal infections. Despite the lower pH of the vaginal secretions during pregnancy, staphylococci, streptococci, diphtheroid and anaerobic bacteria are the common inhabitants. Additionally, pathogens such as *L. monocytogenes* or *N. gonorrhoeae* harboured in chronic cervical lesions pathogens may be acquired by the fetus during delivary (Klein, 2001; Gibb, 2002; Nelson and Macones, 2002).

Postpartum (Postnatal) Infections

After birth, the neonate may acquire postnatal infections by horizontal transmission either with hospitalization (nosocomial) or without hospitalization (Mussi-Pinhata and Nascimento, 2001).

Postnatal infections without hospitalization including the infections that become overt early (during the first week of life), which are frequently caused by pathogens transmitted from the mother or the members of family. These infections present a characteristic epidemiology, neonates that remain in contact with the mother and are naturally breastfed can be colonized on the skin and mucous surfaces (nasopharynx, oropharynx, conjunctive, umbilical cord, external genitalia). The most common microorganisms, in this sense are: α-hemolytic streptococci and CoNS, which mostly infect skin, upper respiratory mucosa and umbilical stump, *E. coli* (gastrointestinal tract), *C. albicans* (gastrointestinal tract, vagina, perineal area) and *S. aureus* (skin and mucous surfaces) (Mussi-Pinhata and Nascimento, 2001).

Postnatal infections with hospitalization are a relevant problem because of the large group known nosocomial infections include: *S. aureus*, MRSA, *C. albicans*, *P. aeruginosa*, *Acinetobacter baumannii*, UTI, Hospital-acquired pneumonia, Gastroenteritis, Vancomycin-resistant *Enterococcus* (VRE), etc (Pollack, 2010). The morbidity and mortality from nosocomial infections is enormous. In the United States, more than 2,000,000 nosocomial infections in neonates and adults occur each year which are responsible for almost 50% of the deaths that occur beyond first 2 weeks of life or increase the prolong hospitalization for several weeks (Sohn *et al*, 2001; Mussi-Pinhata and Nascimento, 2001). The rates of incidence of nosocomial infections vary considerably depending on several principals such as the type of hospital characteristics of the neonates *e.g.* gestational age, postnatal age, sex, maternal background, sanitation policy etc (Foca *et al*, 2000).

Blood stream infections represent the most common nosocomial infection of neonates in NICU and many such infections are catheter-related (Ohlsson and Lacy, 2004). Colonizing organisms may enter the bloodstream through breaks in the skin or mucosa or may be introduced through

invasive devices such as vascular catheters, endotracheal tubes, or feeding tubes. Alternatively, nosocomial infection may result from infection of contaminated intravenous solutions or from contaminated formulaor breast milk (Clark *et al*, 2004).

Main routes of nosocomial transmission are contact transmission, droplet transmission, airborne transmission, common vehicle transmission and vector borne transmission.

Contact transmission is either direct-contact of body surface to body surface, which is the most important and frequent mode of transmission, or indirect-contact transmission with acontaminated inanimate intermediate object such as contaminated instruments, dressings, gloves, syringes, vials, bags, etc (Liziolia *et al*, 2003). Droplet transmission is the transmitting of droplets containing microbe mainly by coughing, sneezing, talking and during certain procedures, such as bronchoscopy (Jiang *et al*, 2004).

Airborne transmission is either by airborne droplet nuclei containing microbes or dust particles containing the infectious agent. While, common vehicle transmission by contaminated items, such as food, water, medications, devices and equipment.in addition to vector borne transmission occurs when vectors either mechanical or biological transmit microbes (Liziolia *et al*, 2003; Jiang *et al*, 2004).

The objective of this study is detection of Routs of etiologic bacteria of neonatal infections.

MATERIALS AND METHODS

Collection of samples

During the period of 12 months from first of March 2012 to twenty eight of February 2013, different types of samples were taken according to the clinical presentation of 380, who were admitted to the Preterm Unite and Neonatal Intensive Care Unit (NICU) in Babylon Hospital for Pediatric and Gynecology were investigated for neonate infections. A total of 666 samples were collected from three different sources. These samples included 490 samples were obtained from neonates, 74 maternal and embryonic samples were obtained from maternal and the embryo while he was in utero and 102 Environmental samples from the hospital environment were taken in attempt to detect the source of infections. A written informed consent was obtained from their parents/ guardians. Following detailed clinical examination, according to the doctors, neonates with suspected infection have any one of the clinical symptoms and signs as outlined in chapter one were considered. The relevant perinatal data adopted in this study were: neonatal birth weight, gestational age, sex, age, mode of the delivery, maternal background (time interval between rupture of membrane and delivery, maternal fever, UTI, bleeding, diabetes and previous abortions). The samples are shown in Table 1.

Laboratory diagnosis

The bacterial isolates were diagnosed according to their characteristics and then compared with their characteristic being reported in referential references, e.g. Baron *et al* (1994); Collee *et al* (1996) and MacFaddin (2000).

RESULTS AND DISCUSSION

Etiologic Bacteria of Neonatal Infections

A total of 510 bacterial isolates were identified from 403 different samples revealed positive results for bacterial culture as shown in Table 2. This finding refers to the positive culture with a mixture of bacterial isolates were considerable (Drake and Brogden, 2002). Laboratory diagnosis of bacterial isolates achieved according to the diagnostic characteristics and compared with those characteristic being reported in referential references, e.g. Baron *et al* (1994); Collee *et al* (1996) and MacFaddin (2000). The characteristics being investigated for diagnosis are colonial and cellular morphology, culturing on selective and differential media and biochemical tests. Confirmative tests were further used to confirm the diagnosis of bacterial isolates using API kits and Vitek-2 compact system. Among 510 bacterial isolates, Gram negative bacteria accounted for 284 (55.7%) versus 226 (44.3%) Gram positive bacteria (Table 2).

This finding is in accordance with that of other studies which showed thatGram negative bacteria were responsible in most cases of neonatal sepsis (Shams Al-Deen, 2001; Vincent *et al*, 2009). While another studies showed that Gram positive bacterial isolates were more common than Gram negative (Al-Talib, 2002; Naher *et al*, 2013).

The Routes of Neonate Infections

Among 510 bacterial isolates that were obtained in the present study, 421(82.5%) isolates from neonates, 56(11%) isolates from mother and embryo and 33(6.5%) isolates from environments (Table 3). Samples from mother and embryo revealed isolates more than samples from environments. This finding refferes to the fact that neonate acquired most etiologic bacteria from the mother. Distribution of bacterial types obtained from mother and embryo was detailed in Table 3, as following: Gram

Table 1 : Distribution and type of samples were being collected in this study.

Source of Sample	Type of Sample		No.		Total
Neonates	Blood		131		490
	Urine		72		
	CSF		40		
	Swabs	Oral cavity	129		
		Umbilical cord	32	247	
		Skin	23		
		Eye	20		
		Respiratory secretions	17		
		Nose	14		
		Surgical Wounds	12		
Mothers and Embryo	Amniotic Fluid from women in delivery room (swab)		28		74
	Umbilical Cord Blood from recent neonate in delivery room(swab)		26		
	HVS of Pregnant Women		20		
Environment	Mask Of Mechanical Ventilator		18		102
	Cannulae		15		
	Caesarian Section Theatre		11		
	Nursery		11		
	Curettage Unit		10		
	Floor of Delivery Room		10		
	Stage of Delivery Room		9		
	Disinfectant		8		
	Fluid Sucker		6		
	Catheter		4		
Total					666

negative 17(30.4%) and Gram positive 39(69.6%). Gram positive isolates included staphylococci 16(41%), streptococci 9(23.1%), *List. monocytogenes* and *Baci. cereus* accounted for 7(18%) for each. Distribution of bacterial isolates obtained from environments was detailed in Table 3, as following: Gram negative 16(48.5%) and Gram positive 17(51.5%). At the time when staphylococci accounted for 11(64.8%) of Gram positive isolates, *List. monocytogenes* and *Baci. Cereus* 3(17.6%), no streptococci were detected from environmental samples.

Intrauterine Infections

Intrauterine infection refers to the vertical transmission of pathogens from the mother into the developing fetus may be by ascending or descending pathway. Ascending infection resulted in an initial restricted invasion of the amniotic cavity and causes amnionitis and thus it is the most common route of EOS in neonates (Goldenberg *et al*, 2000; Kaufman and Fairchild, 2004). The isolation of any microbes in amniotic fluid is considered a pathological finding known as microbial invasion of the amniotic cavity (MIAC) and microbiological studies suggest that intrauterine infection accounts for as much as 25–45% of spontaneous preterm deliveries (Hitti *et al*, 2010).

As shown in Table 4, 21 bacterial isolates were obtained from amniotic fluid included both Gram negative and Gram positive bacteria, in descending order as following: *B. cerus* was commonest and accounted 4(19%) and *Entc. faecalis* 3(14.2%) followed by *List. monocytogenes*, *Esch. coli*, *Staph. haemolyticus* and *Staph. saprophyticus* were accounted 2(9.5%) for each.

Finally, *Staph. aureus*, *Staph. epidermidis*, *Staph. warneri, Strp. agalactiae*, *Acin. baumannii* and *Entb. cloacae* were accounted 1(4.8%) for each. Amniotic fluid seems to be vulnerable for infection by different organisms. It has been reported all around the world that amniotic fluid can be easily infected in variable rate by both Gram negative and Gram positive bacteria (Hitti *et*

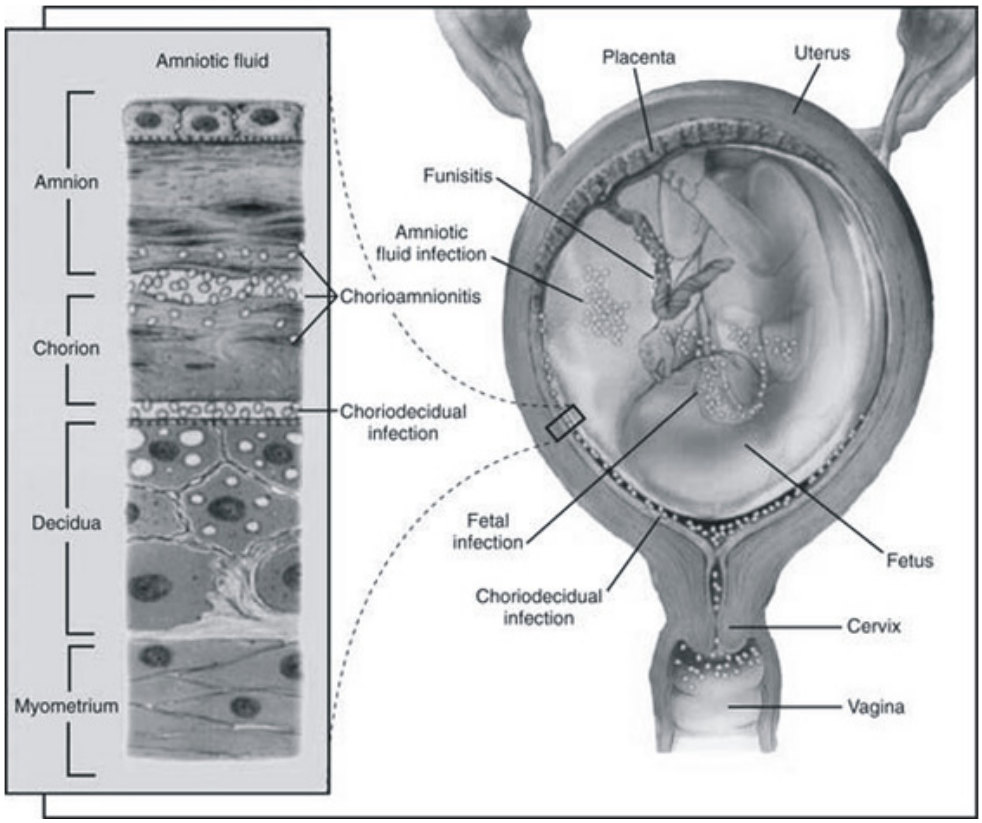

Fig. 1 : Potential sites of bacterial infection within the uterus (Goldenberg, 20).

al, 2010; Digiulio *et al*, 2010; Holst *et al*, 2010).

Microbial transmission directly through transplacenta from the maternal blood stream into the fetus represents the descending pathway (De-man *et al*, 2000). In the current study, blood sample from placental end of umbilical cord was collected and cultured in order to detect descending pathogens. Based on data in Table 4, 12(21.4) bacterial isolates were obtained from umbilical cord blood, *List. monocytogenes* was the commonest which accounted 3(25%)followed by *Entb. aerogenes, Entc. faecalis* and *Strp. agalactiae* were accounted 2(16.7%). Finally, *Prot. mirabilis*, *Entb. cloacae* and *Staph. epidermidis* were accounted 1(8.3%). This finding was different in the bacterial profile with a recent study by Kalathia *et al* (2013) where Gram negative bacteria were predominant in umbilical cord blood samples, with *Pseudomonas* sp. being most frequent followed by *Acinetobacter* sp. , *Esch. coli* and *Klebsiella* sp. Such finding suggested that, fetus is not completely sterile in utero and that a mother-to-child efflux of commensal bacteria through the placenta barrier may exist. In a study by Jimenez *et al* (2005), from 20 samples of umbilical cord blood were collected from neonates born by cesarean section, 9(45%) resulted in bacterial growth and all the isolates were gram-positive cocci. On the other hand, Dasanayake *et al* (2001) and Jimenez *et al* (2005) suggested that oral bacteria can enter the uterine environment through the bloodstream and may influence the delivery process.

Intrapartum Infections

During delivery, the fetuse may be acquire initial bacterial colonization during the passage through vagina (Nelson and Macones, 2002).

As shown in Table 4, 23(41.1%) isolates were obtained from HVS samples. It is higher than amniotic fluid and umbilical cord blood samples in isolation rat which indicated that the fetus acquires most bacterial pathogens during passage through vagina. Several reports have correlated between the density of maternal colonization with the rate of neonatal colonization, neonates born to mother and embryo with heavy colonized birth canal were likely to acquired infection than those delivered through lightly colonized birth canals (Al-Ani, 2003).

Staph. aureus was the most commen bactria which accounted 4(17.4%), followed by *Baci. cereus* 3(13%), *Klebs. pneumoniae*, *Esch. coli*, *Entb. cloacae* and *List. monocytogenes* were accounted 2(8.8%) for each, while 1(4.3%) for each *Entb. aerogenes*, *Prot. mirabilis*, *Acin. baumannii*, *Staph. epidermidis*, *Staph. saprophyticus*,

Table 2 : Distribution of bacterial isolates detected in different samples.

Bacterial isolate / Sample (source)	Gram negative bacteria(%)	Gram positive bacteria(%)	Total (%)
Oral Cavity swab	122 (70.1%)	52 (29.9%)	174(34.0%)
Blood	40 (41.7%)	56 (58.3%)	96(18.8%)
Urine	49 (70.0%)	21 (30.0%)	70(13.7%)
Umbilical Cord swab	16 (50.0%)	16 (50.0%)	32(6.3%)
HVS	9 (39.1%)	14 (60.9%)	23(4.5%)
Amniotic Fluid	4 (19.0%)	17 (81.0%)	21(4.1%)
Skin swab	2 (13.3%)	13 (86.7%)	15(2.9%)
Umbilical Cord Blood	4 (33.3%)	8 (66.7%)	12(2.4%)
Respirotary Secretions swab	8 (72.7%)	3 (27.3%)	11(2.2%)
Eye swab	8 (80.0%)	2(20.0%)	10(1.9%)
Caesarian Section theatre	4 (44.4%)	5 (55.7%)	9(1.8%)
Nasal swab	2 (33.3%)	4 (66.7%)	6(1.2%)
Surgical wound swab	1 (25.0%)	3 (75.0%)	4(0.8%)
Curettage Unit	0 (0.0%)	4 (100.0%)	4(0.8%)
Nursery	2 (50.0%)	2 (50.0%)	4(0.8%)
CSF	3 (100.0%)	0 (0.0%)	3(0.6%)
Catheter	2 (66.7%)	1 (33.3%)	3(0.6%)
Stage of D.R.*	2 (66.7%)	1 (33.3%)	3(0.6%)
Disinfectants	2 (66.7%)	1 (33.3%)	3(0.6%)
Fluid Sucker	0 (0.0%)	2 (100.0%)	2(0.4%)
Mask of Ventilatore	2 (100.0%)	0 (0.0%)	2(0.4%)
Cannulae	1 (50.0%)	1 (50.0%)	2(0.4%)
Floor of D.R.	1 (100.0%)	0 (0.0%)	1(0.2%)
Total	284(55.7%)	226(44.3%)	510

HVS of third trimester pregnant women in Baghdad whereas this bacteria did'nt isolate from HVS the present study. On the other hand, this finding was in accordance with recent studies which mentioned that *Staph. aureus*is a part of the normal humanflora in the urogenital tract and mothers who are colonized with *this bacteria*during their third trimester of pregnancy or at the time of delivery are more likely to have neonate who carry it (Kenneth, 2012; Jimenez-Truque *et al*, 2012). The incidence of *List. monocytogenes* was high in contrast with Stepanovic *et al* (2007) where a low rate of *List. monocytogenes* vaginal carriage of 0.1% was established among women of reproductive age in Belgrade, Serbia. On the other hand, most valiable evidences suggested that rectum may be reservoir for bacteria and genital tract colonization may reflect contamination from the rectum (Al-Ani, 2003).

Postpartum (Nosocomial) Infections

The results arrived by this study revealed that 35 bacterial isolates were obtained from samples of hospital environmente and its distribution as following: 9(25.7%) Caesarian Section theatre, 5(14.3%) Disinfectants, 4(11.4%) for each curttage unit and nursery, 3(8.6%) for each catheter and stage of delivery room, 2(5.7%) for each fluid sucker, mask of ventilator and cannulae. Finally, 1(2.9%) floor of delivery room (Table 4). Based on this data, the first order of isolation rate was Caesarian Section theatre followed by curttage unit and nursery. In Disinfectants, *Psed. aeruginosa* has highest isolation rate 3(60%). In curttage unit, the frequency of isolates was equal for *List. monocytogenes*, *Staph. lentus*, *Staph. saprophyticus* and *Baci. cereus* were accounted 1(25%). While *Acin. baumannii* has highest frequency 2(50%) in nursery. In other environmental samples, the frequency of bacteria was equal without predomenince of a type overe on other types.

Table 3 : Distribution of bacterial isolates according to the sources.

Bacterial isolates / Sources	Gram negative	Gram positive				Total
		Staphylococci	Streptococci	*List. monocytogenes*	*Baci. cereus*	
Neonates	251(59.6%)	104(61.2%)	46(27.1)	13(7.6%)	7(4.1%)	421(82.5%)
		Total of Gram positive isolates from neonates = 170(40.4%)				
Mother and embryo	17(30.4%)	16(41%	9(23.1%)	7(18%)	7(18%)	56(11%)
		Total of Gram positive isolates from mother and embryo= 39(69.6%)				
Environment	16(48.5%)	11(64.8%)	——	3(17.6%)	3(17.6%)	33(6.5%)
		Total of Gram positivre isolates from environments= 17(51.5%)				
					Total	510

Staph. warneri, *Staph. caprae* and *Entc. Faecalis* (Table 4). This results in contrast with those results reported by Al-Ani (2003), who isolated *Strp. agalactiae* from 24%

Published reports stated that neonates are normally colonized within 48 hours after birth by both Gram negative and Gram positive bacteria. this process is much

Table 4 : The Routes of neonate infections.

The routes		**from Mother and E**			**From Environment: Postpartum (Nosocomial)**									
		Intraurerin												
Bacteria		**Amniotic fluid**	**Umbilical cord blood**	**Intrapartm HVS**	**Caesarian section**	**Curettage unit**	**Nursery**	**Catheter**	**Stage of D.R.***	**Disinfectants**	**Fluid sucker**	**Mask of ventilator**	**Cannulae**	**Floor of D.R.***
Psed. aeruginosa	No	–	–	–	2	–	–	1	–	3	–	–	1	1
	%	–	–	–	22.2	–	–	33.3	–	60	–	–	50	100
Klebs. pneumoniae	No.	–	–	2	–	–	–	–	1	1	–	–	–	–
	%	–	–	8.8	–	–	–	–	33.3	33.3	–	–	–	–
Esch. coli	No	2	-	2	1	-	-	-	1	-	-	-	-	-
	%	9.5	-	8.8	11.1	-	-	-	33.3	-	-	-	-	-
Entb. aerogenes	No	-	2	1	1	-	-	-	-	-	-	-	-	-
	%	-	16.7	4.3	11.1	-	-	-	-	-	-	-	-	-
Prot. mirabilis	No	-	1	1	-	-	-	1	-	-	-	-	-	-
	%	-	8.3	4.3	-	-	-	33.3	-	-	-	-	-	-
Entb. cloacae	No	1	1	2	-	-	-	-	-	-	-	-	-	-
	%	4.8	8.3	8.8	-	-	-	-	-	-	-	-	-	-
Acin.baumannii	No	1	-	1	-	-	2	-	-	-	-	1	-	-
	%	4.8	-	4.3	-	-	50	-	-	-	-	50	-	-
Citr. frundii	No	-	-	-	-	-	-	-	-	-	-	1	-	-
	%	-	-	-	-	-	-	-	-	-	-	50	-	-
Staph. aureus	No	1	-	4	1	-	-	-	-	-	1	-	-	-
	%	4.8	-	17.4	11.1	-	-	-	-	-	50	-	-	-
Staph. epidermidis	No.	1	1	1	-	-	1	1	-	-	-	-	-	-
	%	4.8	8.3	4.3	-	-	25	33.3	-	-	-	-	-	-
Stap. haemolyticus	No	2	-	-	-	-	-	-	-	-	-	-	-	-
	%	9.5	-	-	-	-	-	-	-	-	-	-	-	-
Staph saprophyticus	No	2	-	1	1	1	-	-	-	-	-	-	-	-
	%	9.5	-	4.3	11.1	25	-	-	-	-	-	-	-	-
Staph. xylosus	No	-	-	-	1	-	1	-	-	-	-	-	-	-
	%	-	-	-	11.1	-	25	-	-	-	-	-	-	-
Staph. warneri	No	1	-	1	-	-	-	-	-	-	-	-	-	-
	%	4.8	-	4.3	-	-	-	-	-	-	-	-	-	-
Staph. lugdunensis	No	-	-	-	-	-	-	-	-	-	-	-	1	-
	%	-	-	-	-	-	-	-	-	-	-	-	50	-
Staph. caprae	No	-	-	1	-	-	-	-	-	-	-	-	-	-
	%	-	-	4.3	-	-	-	-	-	-	-	-	-	-
Staph. lentus	No	-	-	-	-	1	-	-	-	1	-	-	-	-
	%	-	-	-	-	25	-	-	-	33.3	-	-	-	-
Entc. faecalis	No	3	2	1	-	-	-	-	-	-	-	-	-	-
	%	14.2	16.7	4.3	-	-	-	-	-	-	-	-	-	-
Strp. agalactiae	No	1	2	-	-	-	-	-	-	-	-	-	-	-
	%	4.8	16.7	-	-	-	-	-	-	-	-	-	-	-
List. monocytogenes	No	2	3	2	1	1	-	-	1	-	-	-	-	-
	%	9.5	25	8.8	11.1	25	-	-	33.3	-	-	-	-	-
Baci. cereus	No	4	-	3	1	1	-	-	-	-	1	-	-	-
	%	19	-	13	11.1	25	-	-	-	-	50	-	-	-
Total	**No**	**21**	**12**	**23**	**9**	**4**	**4**	**3**	**3**	**5**	**2**	**2**	**2**	**1**
	%	**37.5**	**21.4**	**41.1**	**25.7**	**11.4**	**11.4**	**8.6**	**8.6**	**14.3**	**5.7**	**5.7**	**5.7**	**2.9**
		56			**35**									

*** D.R. = Delivery Room.**

quicker, if they require resuscitation at birth or are admitted to NICU and Most frequent bacteria, which acquired from environment and causing neonatal infection are *Staph. epidermidis*, *Esch. coli*, *Staph. aureus*, *List. monocytogenes*, *Strp. pneumoniae, Psed. aeruginosa, Citrobacter* sp., *Enterobacter* sp., in addition to *Serratia* sp. and *Salmonella* sp. (Haque, 2010).

In current study, the wide variety of bacterial types which isolated from hospital environment with predominance of Gram negative bacteria may be attributed to that most nosocomial pathogens can persist on inanimate surfaces for weeks or even months, a study by Kramer *et al* (2006) demonstrated that most Gram positive bacteria, such as *Enterococcus* spp. (VRE), *Staph. aureus* (MRSA), *Strp. pyogenes* and many Gram negative bacteria such as *Acinetobacter* spp., *Esch. coli, Klebsiella* spp., *Psed. aeruginosa, Serratia marcescens* and *Shigella* spp., can survive for months on dry surfaces. Overall, Gram negative bacteria have been described to persist longer than Gram positive.

Persistence for most types of bacteria, e.g. *List. monocytogenes*, *Psed. aeruginosa*, *Esch. coli* and other relevant pathogens was improved by humidity conditions. While *Staph. aureus* was found to persist longer at low humidity, whereas spore-forming bacteria, including *Baci. cereus* can also survive for many months on surfaces at low humidity (Lemmen *et al,* 2004; Williams *et al,* 2005).

Most available evidences indicate that, the main route of transmission in hospitals is via the transiently contaminated hands of the healthcare worker that may serve as vectors for cross transmission, which was most successful with *Esch. coli*, *Salmonella* spp. and *Staph. aureus*, thus, a single contaminated hand results in a variable degree of nosocomial pathogen transfer (Bures *et al,* 2000; Duckro *et al,* 2005).

Some reports suggest that, during outbreaks in hospitals, the environment may play a significant role for transmission of nosocomial pathogens, as suggested by observational evidence has been described for various types of bacteria, e.g., *Acin. baumannii, Clostridium difficile*, MRSA, multi-druge resistant *Psed. aeruginosa,* VRE (Denton *et al,* 2004; Fitzpatrick *et al,* 2000; Duckro *et al,* 2005).

The role of surface disinfection for the control of nosocomial pathogens has been a contentious issue because routine treatment of clean floors with various types of surface disinfectants has been described to have no significant impact on the incidence of nosocomial infections (Cozad and Jones, 2003). On the other hand, disinfection has been recommended to reduce acquisition of nosocomial pathogens such as VRE or *Acin. baumannii* (Hayden *et al*, 2006; Wilks *et al*, 2006).

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