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Study on some Bacteriological and Immunological aspects of Septicemia in Neonate in Baghdad

KEYWORDS: neonatal sepsis, blood culture, Antibiotic sensitivity, immunoglobulines, complement components.

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ABSTRACT *One hundred blood specimens were collected from neonatal patients below twenty eight days whom suspected to have septicemia in Baghdad pediatric hospitals. The results have revealed that 34(34 %) gave positive blood culture whereas 66 (66 %) gave no growth. among 34 positive blood culture cases 21 (61.76%) were males and 13 (38.24%) were females. Among 34 positive blood culture cases 24 (70.59%) belonged to late onset neonatal sepsis (LONS) and 10 (29.41%) belonged to early onset neonatal sepsis (EONS). So the incidence was higher in LONS than EONS.Among 34positive blood culture cases twenty (58.82%) were of low birth weight (LBW) and fourteen (41.18%) were of normal birth weight (NBW) so the incidence of neonatal septicemia was higher in LBW neonates compared to NBW. NNS were 22 cases (64.70%) preterm and 12 (35.30%) were term. The incidence of preterm neonates was higher compared with term neonates.Gram-positive bacteria were (52.94%) which higher than Gram-negative bacteria (47.06%). Burkholderiacepacia is isolated from neonatal sepsis(NNS) for the first time in Baghdad accordingly to our information subject.Antibiotic sensitivity test was detected by using Kirby-Bauer methodandVancomycin was the most effective antibiotics on gram-positive bacteria while imipenem and amikacin were the most effective antibiotics on gram-negative bacteria.*

The immunological aspect was done by determination of the concentration of immunoglobulines (IgA, IgG and IgM) and some complement components (C3 and C4) in neonates(12 of NNS and 12 control neonates) serum.The mean of concentrations of preterm control neonate IgA 20.3 mg/dl, IgG512.5 mg/dl, IgM 16.6 mg/dl, C3 77.7 mg/dl and C4 17.7 mg/dl were lower than mean of concentrations of term control neonate IgA 23.6 mg/dl, IgG851.1 mg/dl, IgM 18.9 mg/dl, C3 126.5 mg/dl and C4 24.6 mg/dl, the mean of concentrations of preterm NNSIgG350.5 mg/dl, C3 56.6 mg/dl and C4 13.6 mg/dl were significant (P<0.05) lower than mean of concentrations of preterm control neonate IgG512.5 mg/dl, C3 77.7 mg/dl and C4 17.7 mg/dl and IgM 28.9 mg/dl of preterm NNSwas significant (P<0.05) higher than mean of concentrations of preterm control neonate IgM 16.6 mg/dl while non significant of IgA and we showed that the mean of concentrations of term NNSIgG492.5 mg/dl, C3 67.4 mg/dl and C4 16.7 mg/dl were significant (P<0.05) lower than mean of concentrations of term control neonate IgG851.1 mg/dl, C3 126.5 mg/dl and C4 24.6 mg/dl and IgM 34.8 mg/dl of term NNSwas significant (P<0.05) higher than mean of concentrations of term control neonate IgM 18.9 mg/dl while non significant of IgA, thus the relative risk of acquiring sepsis in neonates was greater with IgG 350.5 ± 76.7 mg/dl.

Introduction

Neonatal sepsis (NNS) is one of the major health problems throughout the world every year. Thirty million newborns acquire infection and 1-2 million of them die (1).Neonatal sepsis is a dangerous condition that affects between 0.1-1% of newborns but among extremely preterm infants incidence rates as high as 30-40% have been reported. Neonatal sepsis causes increased mortality and morbidity (2). Diagnosis of neonatal septicemia is ultimately based on the positive blood culture which is the gold standard at least 48-72 hours is needed. Positive blood culture may not always establish diagnosis of neonatal septicemia. It may be positive due to contamination or transient bacteremia. At the same time negative blood culture dose not exclude sepsis. bacteremic phase may be missed by blood sample size. The most widely accepted sample size is 0.5 to 1.0 ml. The blood must be collected before starting any antibiotic therapy therefore we need more tests or indicators like parameters immunology. In the United States and Canada the current approach to the treatment of early-onset neonatal sepsis includes combined intravenous aminoglycoside and expanded-spectrum penicillin antibiotic therapy. This providescoverage for gram-positive and gram-negative bacteria. (1).

The fetus has some preformed immunoglobulin G (IgG) present primarily acquired through nonspecific placental transfer occurs in late gestation such that lower levels are found with increasing prematurity. The neonate's

ability to generate immunoglobulin M (IgM) in utero at 10 weeks' gestation, IgM levels are generally low at birth unless the infant was exposed to an infectious agent during the pregnancy thereby stimulating increased IgM production. The neonate may receive immunoglobulin A (IgA) from breast feeding but does not secrete IgA until 2-5 weeks after birth. Complement protein production can be detected as early as 6 weeks' gestation, the concentration of the various components of the complement system widely varies among individual neonates. Although some infants have had complement levels comparable to those in adults (3).

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In Iraq there are few studies on neonatal septicemia as septicemic disease in newborn babies in addition to very little information available about the immunological parameters. So this studywas aimedto shed light about some causative agents (aerobic bacteria) ofneonatal sepsis and some immunological parameters (some Immunoglobulines and complement components).

Methods

Specimens collection

Patients

Specimenswere obtained from the patients, before starting antibiotic therapy, according to the method stated by Forbes *et al*. (4).

A total of Hundred patients of neonate below twenty eight days which suspected to have septicemia, clinically diagnosed by pediatric physicians and twelve from neonates without septicemia as a control six of them were term and other six were preterm in Baghdad pediatric hospitals (Central Pediatric Teaching Hospital, Ibn Al Baladi Pediatric Hospital, Al Alwaiya Children Teaching Hospital, Child Protection Teaching Hospital) and at a period from Oct 2010 to Aug 2011.

Healthy neonates (control)

Twelve blood samples were taken from healthy neonates six of them term neonates (≥ 36 weeks of gestational age) and the other six are preterm neonates (< 36 weeks of gestational age) which were used in immunological test.

Isolation and Identification of bacterial isolates

Blood culture inoculation

The blood sample (1 ml) weretaken from the patients before antibiotic therapy and immediately inoculated into sterilized Brain heart infusion broth (BHIB) bottle (20ml) then put inincubated for 24 hours at 37°C which used as enrich media for aerobic culture.

Colonial morphology and microscopic examination

The colonial morphology has been studied in respect to the 24-72 hours at aerobic conditions. The bacterial growth was examined microscopically by using Gram's stain technique (4).

Biochemical tests

Allbiochemical tests(catalase test,oxidase test and coagulase test) were done according toForbes *et al*. (4).

Identification system (Diagnostic kits)

Themicroorganisms were identified at species level by usingAnalytic Profile Index (API) system (Bio-Merieux/France) including:

API Staphfor the identification of the *Stphylococcus*spp, API 20 E which is a standardized identification system for Enterobacteriaceae (*Escherichia coli*, *Enterobacter cloacae*, *Klebsiellapneumoniae*and *Serratiamarcescens*) and API 20 NE which is a standardized system for the identification of *Pseudomonas aeruginosa*,*Burkholderiacepacia*, *Pasteurella*spp.

Antibiotic sensitivity test

The Antibiotic sensitivitytest was performed according to Kirby-Bauer (disk diffusion) technique (5), using Muller-Hinton agar and different single antimicrobial discs supplied commercially (table -1).

Table-1: Antibiotic discs used in this work.

Antibiotics & Concentration disks	Campany/Origin
Amikacin (AK) 30µg	Mast /England
Amoxycillin/Clavulanicacid(AMC) 20/10µg (30µg)	Mast /England
Ampicillin (AMP) 10µg	Mast /England
Cefazolin (CZ) 30 µg	Mast /England
Cefotaxime (CTX) 30 µg	Mast /England
Ceftazidime (CAZ) 30 µg	Mast /England
Chloramphinical (C) 30 µg	Mast /England
Ciprofloxacin (CIP) 5µg	Mast /England
Gentamycin (GEN) 10 µg	Mast /England
Imipenem (IMP) 10 µg	Mast /England
Oxacillin (OX) 1 µg	Mast /England
Pencillin G (P) 10 units	Mast /England
Piperacillin (PI) 100 µg	Mast /England
Peperacillin/Tazobactam (PIT) 100/10 µg	Mast /England
Trimethoprim-sulfamethoxazole (COT) 1.25/23.75 µg	Mast /England
Vancomycin (VA) 30 µg	Mast /England

The resulting zones of inhibition were measured by a ruler and compared with the zones of inhibition determined by Franklin *et al*. (6).

immunological test

Singles Radial Immunodiffusion test

Singles Radial Immunodiffusion (SRID) test were used for the quantitative determination of many human serum proteins such as IgA, IgG, IgM, and C_3, C_4 complements.

Procedure

A- The sera (12 of patients and 12 of control) were removed from freezing and equilibrated to room temperature.

B-partigen plates were getting refrigerator then ziplock bag and lid removed, wells were inspected for moisture. If moisture was present, uncovered plates were allowed to remain at room temperature (approximately 15 minutes) until moisture evaporated.

C- Sera of patients and control were shaken (in their own containers) by inversion, each sample was dispensed onto the appropriate wells. Each well required 5 µl of serum.

D- After lid was replaced, it was incubated at room temperature 26 C° on a level surface. Incubation times were 48 hours for IgG, IgA, C_3 and C_4 tests and 72 hours for IgM tests.

E-Immunopreciptin ring diameters were measured by hand lens (0.1 mm precision). The calculated diameters were compared to the standard diameter to conclude the concentrations of serum humoral factors (7).

Statistical analysis

The statistical analysis system-SAS (2004) was used to ef-

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fect of difference factors in study parameters. T-test was to the comparative between means in this study.

Results and discussion

Neonatal septicemia (NNS) constituted 34 from a total of 100 patients which's randomly chosen with age range 1-28 days and have specific clinical diagnosis by specialized physicians in pediatrics hospitals these 34 cases of NNS included 21 males and 13 females and they were all divided into 2 age groups early onset neonatal septicemia (EONS) with age 3days and late onset neonatal septicemia (LONS) with age 4-28 days.

Effect of gender on the neonatal septicemia

According to the NNS patients gender, out of 100 suspected cases 69 were males (69%) and 31 were females (31%), among 34 positive blood culture cases 21 (61.76%) were males and 13 (38.24%) were females so males were higher in number compared to females.

In a study conducted by Vaidya*et al.*, (8) during one year the suspected cases were 381 (156 had positive blood culture 40.9 %) in Kem Hospital India male to female ratio was 1.6 : 1 from positive blood culture cases. The suspected cases were 592 (72 had positive blood culture 12.16 %) in neonatal units of Beheshti hospital in Kashan Iran reported 68% were males and 32% were females (9).

Effect of age on the neonatal septicemia

According to the NNS age results, out of 100 suspected cases 30 (30%) belonged to EONS and 70 (70%) belonged to LONS. Among 34 positive blood culture cases 10 (29.41%) belonged to EONS and 24 (70.59%) belonged to LONS therefore the incidence was higher in LONS than EONS.We found that LONS was more common than EONS which is in agreement with the reports from other countries.In Libyan Arab Jamahiriya of Al-Fatah Children's hospital in Benghazi the cases of 36 neonates seen in the neonatal unit, LONS 69 % and EONS 31 % (10). In Pakistan of Nishtar hospital of Multan 115 (62 had positive blood cultures) cases of clinically suspected NNS. Late onset neonatal septicemia was 36 (58 %) of NNS and early onset neonatal septicemia was 26 (42 %) of NNS (11). There are some studies disagreedwith these results. In Iran at Beheshti hospital in Kashan from September 2002 to September 2005. One thousand and six hundred eightyof neonates 36 % had positive blood culture, EONS was 77.5 % and LSNO was 22.5 % (12).

The most common cause of LONS is nosocomial infection as a complication of neonatal intensive care; LONS mainly affects premature or low birth weight infants. The incidence of LONS in low birth weight neonatal has been reported as 17-30% in large national study including all new born patients in Sweden with prematurity 41 % of the surviving newborn had at least one positive blood culture and in American study including newborn with prematurity the rate of EONS was 2% and the rate of LONS was 36 % (13).

Effect of birth weight on the neonatal septicemia

According to the birth weight of NNS patients, out of 100 suspected cases 61 (61%) were low birth weight (LBW) and 39 (39 %) were normal birth weight (NBW). Among of 34 positive blood culture cases 20 (58.82%) were of LBW and 14 (41.18%) were of NBW so the incidence of neonatal septicemia was higher in LBW neonates compared to NBW. These findings were similar to the results of Lee *et al.*, (14) in the incidence of septicemia in there neonatal intensive care unit (NICU).The positive blood culture was 87 from 623, The normal birth weight of NNS (≥ 2.5kgs) was 25.9% and Low birth weight of NNS (<2.5kgs) was 74.1%.

Effect of gestation age on neonatal septicemia

According to the gestation age neonatal septicemia results,out of one hundred suspected cases 61 (61 %) were preterm neonates (< 36 weeks) and 39 (39%) were term neonates (≥ 36 weeks). Among positive culture 22 cases (64.70%) were preterm neonates and 12 (35.30%) were term neonates. The incidence of preterm neonates was higher compared with term neonates.

Similar reports in incidence of (preterm and term neonate) have been made by other worker. In the study conducted by Cohen-Wolkowiez*et al.* (15) in the incidence of septicemia in there NICU in the Pediatrics Medical Group cared in the United States The positive blood culture was (248 / 527), The preterm neonates of NNS was 69 % and term neonates of NNS was 31%. The preterm neonates is a greater risk for infection than the term because generally require longer hospital stays and more medical procedures, both of which increase their risk for late-onset neonatal sepsis.

Bacterial isolates from cases of neonatal septicemia according to Gram staining

Gram-positive bacterial isolates appeared to be predominant type according to the results shown in figure-1: 18/34 (52.94%), when compared to Gram-negative bacteria were 16/34 (47.06%) cases.These results were in accordance with the finding of Mokuolu*et al.* (16) the study gave Gram positive bacteria isolated of NNS were 57% and Gram-negative bacteria were 43%.

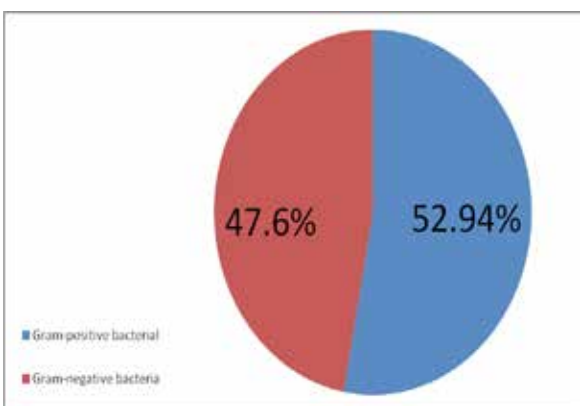

Figure -1: Bacterial isolated for neonatal septicemia according to Gram staining.

Bacterial isolates responsible for Early onset neonatal septicemia (EONS) and Late onset neonatal septicemia (LONS) of neonatal septisemia NNS and number of death

Types and frequencies of bacteria isolated from NNS cases which in relation to early and late onset of NNS and the number of death are shown in table-2. Gram-positive were *Staphylococcusaureus* (17.64 %), *Staphylococcus epidermidis* (14.71%), *Staphylococcus capitis* (11.76%), *Staphylococcus hominis* (5.88%), *Staphylococcus xylosus* (2.94%). and Gram-negative were *Escherichia coli* (11.76%), *Enterobacter cloacae* (8.82%), *Klebsiellapneumoniae* (8.82%), *Pseudomonas aeruginosa* (5.88%), *Pasteurellaspp* (5.88%), *Burkholderiacepacia* (2.95%),*Serratiamarcescens* (2.95%). *Burkholderiacepacia*is isolated from NNS for the first time in Baghdad accordingly to our information subject.

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Table -2: Type and frequencies of bacteria responsible for (EONS) and (LONS) of NNS and number of death.

Type of bacteria NO. (%)			EONS			LONS			Total		
			No. of Death	NO	(%)	NO. of Death	NO.	(%)	NO. of Death		
Gram positive bacteria	Coagulase Negative *Staphylococcal* (CONS) *group*		3	8.82	0	9	26.50		12	35.32	0
	I	*Staphylococcusepidermidis*	1	2.95	0	4	11.76	0	5	14.70	0
	II	*Staphylococcuscapitis*	1	2.95	0	3	8.82	0	4	11.76	0
	III	*Staphylococcushominis*	1	2.95	0	1	2.95	0	2	5.88	0
	IV	*Staphylococcusxylosus*	0	0.00	0	1	2.95	0	1	2.95	0
	Coagulase positive *Staphylococcal* (COPS) *group* I- *Staphylococcus aureus*		1	2.95	0	5	14.70	0	6	17.64	0
Gram negative bacteria	*Escherichia coli*		3	8.82	0	1	2.95	0	4	11.76	0
	Enterobacter cloacae		1	2.95	0	2	5.88	0	3	8.82	0
	Klebsiellapneumoniae		1	2.95	0	2	5.88	0	3	8.82	0
	Pseudomonas aeruginosa		1	2.95	1	1	2.95	0	2	5.88	1
	Pasteurellaspp		0	0.00	0	2	5.88	0	2	5.88	0
	Burkholderiacepacia		0	0.00	0	1	2.95	0	1	2.95	0
	Serratiamarcescens		0	0.00	0	1	2.95	0	1	2.95	0
Total			10	29.41	0	24	70.59	1	34	100	1

Coagulase negative staphylococcalare reported to be the most frequent bacteria (35.32%) of isolated NNS. LONS (26.50%) is higher than EONS (8.82%).These findings agree with Lee *et al.*, (14) who reported that CONS was predominant (29%) in there isolateswhileLONS (26.43 %)was higher than EONS (2.29 %). Additionally Singh *et al.* (17), showed that theCONS were the most frequent (14.09%) bacteria of NNS, LONS (10.73 %) and was higher than EONS (3.36 %).

The most distributed bacteria among Gram-negative of NNS isolates were *Escherichia coli* (11.76 %). EONS (8.82%) is higher than LONS (2.95%). These findings were agreed with Gheibi*et al.*, (18) reported that *Escherichia coli* was predominant Gram negative (11.45%), EONS (7.48 %) was higher than LONS (3.97 %).

Antibiotic sensitivity test

Antibiotic sensitivity test was detected by using Kirby-Bauer Method andthe zones of inhibition determined by Franklin *et al.* (6).*Staphylococcus*

spp. resisted Penicillin and Oxacillin were higher than other types of antibiotics include Chloramphinicol (C), Ciprofloxacin (CIP). and Gentamicin (GEN). While all strain were sensitive to Vancomycin. Enterobacteriaceae (*Escherichia coli*, *Enterobacter cloacae*, *Klebsiellapneumoniae*and *Serratiamarcescens*) showed remarkable resistancy to Ampicillin (AMP), Piperacillin / Tazobactamfrom (PIT), Cefazolin (CZ) and Cefotaxime (CTX) while no resistancy to Imipenem (IMP) and Amikacin(AK). *E coli* resisted ceftazidime (CAZ), *Enterobacter cloacae* resisted GEN, *Klebsiellapneumoniae* resisted CIP. On the other hand *Serratiamarcescens* was sensitive to most antibiotics except AMP and CZ. *Pasteurellaspp* were sensitive to most antibiotics except Piperacillin (PI) and PIT. *Pseudomonas aeruginosa* were sensitive to CAZ, IMP and AK while half of isolate resisted PI, PIT, GEN and CIP. *Burkholderiacepacia* were sensitive to CAZ, IMP and resisted Trimethoprim-sulfamethoxazole, GEN and C.

immunological tests

According to The concentrations of IgA, IgG, IgM, C3 and C4 in out of 12 control neonates (controls) 6 of them were term and other 6 were preterm showed in table -3. The result have found that the mean of concentrations of preterm control neonate IgA 20.3 mg/dl, IgG512.5 mg/dl, IgM 16.6 mg/dl, C3 77.7 mg/dl and C4 17.7 mg/dl were lower than mean of concentrations of term control neonate IgA 23.6 mg/dl, IgG851.1 mg/dl, IgM 18.9 mg/dl, C3 126.5 mg/dl and C4 24.6 mg/dl.

This finding agrees with Ashari*et al.*,(19) there have been found that the mean of concentrations of preterm control neonate IgA, IgG, IgM, C3 and C4 were lower than term control neonates. The levels of Immunoglobulin and some complement system remain low up to the last trimester and the newborn can synthesize them and this ability increases with gestational age, there is no transfer via placental expatiation IgG(20).

The mean of concentrations of preterm NNSIgG350.5 mg/dl, C3 56.6 mg/dl and C4 13.6 mg/dl were significant ($P<0.05$) lower than mean of concentrations of preterm control neonate IgG512.5 mg/dl, C3 77.7 mg/dl and C4 17.7 mg/dl and IgM 28.9 mg/dl of preterm NNSwas significant ($P<0.05$) higher than mean of concentrations of preterm control neonate IgM 16.6 mg/dl while non significant of IgA and we showed that The mean of concentrations of term NNSIgG492.5 mg/dl, C3 67.4 mg/dl and C4 16.7 mg/dl were significant ($P<0.05$) lower than mean of concentrations of term control neonate IgG851.1 mg/dl, C3 126.5 mg/dl and C4 24.6 mg/dl and IgM 34.8 mg/dl of term NNSwas significant ($P<0.05$) higher than mean of concentrations of term control neonate IgM 18.9 mg/dl while non significant of IgA in table -3.

This finding agrees with Kadhim, (21) in her work she reported that some immunological parameters were helpful in enhancing the ability to diagnose sepsis like IgM (≥20) mg/dl significantly associated with neonatal sepsis. Ad-

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ditionally Pierrakoset *al.*, (22) showed that some complement (C3, C4) levels distinguished between sepsis and non sepsis at 28 days. A serum level of 400 mg/dl of total IgG appears to be critical to prevent the newborn from infection as none of the infants in our cohort who attained level above 400 mg/dl died from infection whilst all the infants who died from sepsis had levels below 400 mg/dl. The foetus normally achieves this level of total IgG around 32 weeks of gestation and it is not surprising that infection is highest before 32 weeks of gestation (23).

The fetus has some preformed immunoglobulin G (IgG) present primarily acquired through nonspecific placental transfer occurs in late gestation such that lower levels are found with increasing preterm. The neonate's ability to generate immunoglobulin M (IgM) in utero at 10 weeks' gestation IgM levels are generally low at birth unless the infant was exposed to an infectious agent during the pregnancy thereby stimulating increased IgM production.The neonate may receive immunoglobulin A (IgA) from breast feeding but does not secrete IgA until 2-5 weeks after birth**.** Complement protein production can be detected as early as 6 weeks' gestation, the concentration of the various components of the complement system widely varies among individual neonates. Although some infants have had complement levels comparable to those in adults **(3)**.

There are three major of complement deficiencies based on the pathophysiology of each defect are inadequate opsonization, or in cell lysis, and defect the association of complement deficiencies with immune complex diseases (24).

The neonate's ability to generate immunoglobulin in response to antigenic stimulation is intact; the magnitude of the response is initially decreased, rapidly rising with increasing postnatal age **(3).**

Table -3:Concentration of IgA , IgG, IgM, C3 & C4 in term and preterm of normal neonates and neonatal septicemia with T test

Neonates	Group	Mean ± SD				
		IgA	IgG	IgM	C3	C4
Preterm	Control 6 cases	20.3 ± 7.5	512.5 ± 79.9	16.6 ± 7.2	77.7 ± 12.5	17.7 ± 3.0
	Patients (NNS) 6 cases	16.0 ± 5.3	350.5 ± 76.7	28.9 ± 12.0	56.6 ± 14.5	13.6 ± 5.2
T-test value	----	5.79 NS	36.28 *	6.74 *	9.35 *	2.06 *
Term	Control 6 cases	23.6 ± 7.8	851.1 ± 112.5	18.9 ± 4.9	126.5 ± 18.8	24.6 ± 4.6
	Patients (NNS) 6 cases	19.2 ± 5.7	492.5 ± 84.6	34.8 ± 14.2	67.4 ± 11.8	16.7 ± 2.7
T-test value	---	6.01 NS	48.34 *	7.49 *	16.83 *	3.96 *

* (P<0.05)NS: non-significant.

Normal value of neonates: IgA 5-30mg/dl, IgG 400-1250mg/dl, IgM 10-60mg/dl. C_3=80-160 mg\dl and C_4=20-40 mg\dl(7).

Conclusions

- Neonatal septicemia occurs in males were higher in number compared to females.
- Late onset neonatal septicemia was higher than early onset neonatal septicemia.
- Neonates with low birth weight was more common in respected to septicemic than normal birth weight.
- Neonatal septicemia was most frequently in Preterm neonates than term neonates.
- Gram-positive bacteria especially *Staphylococcus aureus* were the most common isolates as a causative agent than gram-negative bacteria.
- Vancomycin was the most effective antibiotics on gram-positive bacteria while imipenem and amikacin were the most effective antibiotics on gram-negative bacteria.
- The mean of concentrations of preterm control neonate IgA, IgG, IgM, C3 and C4 were lower than mean of concentrations of term control neonate IgA, IgG, IgM, C3 and C4.
- The mean of concentrations of preterm NNSIgG, C3 and C4 were significant (P<0.05) lower than mean of concentrations of preterm control neonate and IgM of preterm NNSwas significant (P<0.05) higher than mean of concentrations of preterm control neonate while non significant IgA.
- The mean of concentrations of term NNSIgG, C3 and C4 were significant (P<0.05) lower than mean of concentrations of term control neonate andIgM of term NNSwas significant (P<0.05) higher than mean of concentrations of term control neonate while non significant IgA

The relative risk of acquiring sepsis in neonates was greater with IgG 350.5 ± 76.7 mg/dl.

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