Blood Culture From The Umbilical Vein In The Diagnosis Of Neonatal Sepsis.

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Abstract

Background: Sepsis is a significant cause of mortality and morbidity in Neonatology Departments. Frequently neonatologists use the presence of a positive blood culture to confirm diagnosis and then they undergo lumbar puncture. Positive blood cultures are the gold standard and are used to predict neonatal outcome and determine type of antibiotics combination ant length of treatment. Objective: The aim of this study was to obtain blood culture from umbilical vein in newborns with infection risk factors and seeing if its culture is more sensible for isolating micro-organisms. Design: A prospective study of 784 deliveries with 45 infection risk factors newborns Patients: We select a cohort of newborns with perinatal infection risk factors during 3 months. Clinical data for these neonates were recorded prospectively and in the delivery room a blood sample from the umbilical vein was culture. These neonates were followed during almost the firsts 72 hours of live and clinical and laboratory test was made. Results. We obtained a total sample size in this study of 30 blood cultures. From this sample blood culture was positive in 13 (43%) and negative in 17 (57%). Of the 13 positive blood cultures 7 (54%) neonates presents clinical and laboratory findings and sepsis diagnosis was made, 3 (23%) were considered contaminants and 3 (23%) were bacteraemies. In all neonates serial RBC, leukocyte counts and CRP were made and in newborns with positive blood culture a new blood sample for culture and CSF culture was performed. Conclusions: Diagnosis of neonatal sepsis by positive blood culture in clinical practice is difficulted by maternal antibiotic prophylaxis and blood sample size. Various diagnostics approaches are necessary to make diagnosis and to determine the length of therapy. Umbilical vein samples represented a new and more sensible way to diagnostics early neonatal sepsis.

INTRODUCTION

Neonatal sepsis is high-risk disease with a low incidence(1,2). The early identification of septic neonates is difficulted because subtle initial sings no ever are seen or are not presents. Many approaches are described to detect newborns with initial risk of sepsis, and there are various guidelines(3,4,7) trying to give an accuracy definition of sepsis and only are defined like true sepsis when then blood culture is positive.

The isolation of an organism in a blood culture confers the possibility of an optimal choice and length of antibiotics.

Many known factors(5,6,8) influence the sensibility of blood cultures like maternal antibiotic prophylaxis or time for sample collection. One of the most important risk factor is volume sample (11). To improve this problem is recommended more than one sample recollection, and take almost 1ml, and that's not ever possible.

For theses reasons, a new strategy for obtained blood culture was developed in our centre. The objective of this study was improving the global percentage of positive blood cultures in neonatal sepsis risk newborns obtaining umbilical chord blood samples.

MATERIAL AND METHODS

Previously we designed a new protocol of data collection to include patients with perinatal risk factors (table 1)

Clinical data were registered prospectively and retrospectively analyzed for this article.

Newborns included were born in Clínica Virgen de la Vega hospital from January 2006 to May 2007

Figure 1

Table 1 : Perinatal risk infection factors

- Intra-partum fever >38ºC
- Chorioamnionitis
- Neonatal fever in the delivery room
- Amniotic membrane rupture more than 18hours
- Screening SGB not made or positive with incomplete IAP
- Cervical cerclage
- Abnormality in fetal heart rhytm not from mechanical origin
- Neonatal sepsis infant in a previous delivery

784 neonates were born in this time period with gestational ages between 33 and 42 weeks.

We found infection risk factors in 45newborns; obtaining 30 umbilical chord vein blood samples.

Were recorded data on birth weight, EGA, gender, APGAR score, maternal age, type of delivery, characteristics of amniotic fluid, time of amniotic membrane rupture, maternal temperature, newborns temperature, screening of SGB, blood culture results, clinical evolution and diagnosis when it was made. Were made serial peripheral complete blood counts and peripheral blood culture on newborns.

We obtained an ethics committee approval of our center previously with a write assent of parents.

RESULTS

A total of 30 blood samples were analyzed. Of the newborns mean EGA was 38+4 weeks (range 2670-4020). 60% were male infants and 40% were female.

Median APGAR score were 8,6 and 9,9 at 1 and five minutes.

Of 30 samples 13 were positive, in 10 of blood culture grew a potential bacterial pathogen and included gram positive organism (50%) and gram negative (50%)

Clinical and analitic checking were made at 12, 24 and 48 life hours. (Table 2)

In 7 newborns blood cultures were positive showing clinical and analitic data characteristics of sepsis and was decided to start with antibiotic treatment in 6 patients in his first 24h of life and in one patient before 48h with a satisfactory progress after treatment´s start. In 3 patients blood culture result was considered a contamination (1 St viridans and 2 Staph coag neg) and they have not clinical or laboratory pathological data. 3 cases diagnosis was bacteriemia (1 E.Coli, 1 Citrobacter k y 1 Enterococo)

Figure 2

Table 2 : Clinical, bacteriological and laboratory findings

Case	Birth weight	GA	Type of birth	Apgar	Risk factor	UCBC/PBC	Symptoms	CRP	CSF	WBC
1	3440	39	D	9/10	GBS+ / IAP-/ MF	GBS / neg	Hypotonic	0.31/7.88	Neg	10620/21150
2	4020	39	D + k	9/10	MF / MAL	E.Coli / neg	Alt FC y SatO2	0.41/3.85	Neg	14620/13800
3	2670	33	D	8/9	PreT / GBS?	E.Coli / neg	RD	0.17/0.85	Neg	13900/17000
4	3440	41	D + k	9/10	NF	Enterococcus / neg	NF	0.08/1.65	Neg	18500/19150
5	3460	40	D + k	9/10	MF / FT / NSM / NF	Enterococcus / Enterococcus	Lethargy NF feeding intolerance	0.45/1.76	Pos	13100/12700
6	3980	40	C	8/10	GBS+ / IAP-/NSM	GBS / neg	RD NTX	0.02/1.9	Neg	18520
7	3450	38	D + v	7/10	PRM	Enterococcus / neg	No	0.36/0.68	Neg	19000
8	3900	39	C	7/9	PRM	Staph coag neg / neg	No	0.34/0.25	Neg	12400/13000
9	3240	39	C	9/10	MF / PRM	Staph coag neg/ neg	No	0.05/0.12	Neg	17000/14200
10	3670	41	D + v	8/10	NF / PRM	St viridans / neg	Transient NF	0.08/0.35	Neg	13200/12000
11	2890	38	C	10/10	MHist	Citrobacter k / neg	No	0.35/0.68	Neg	11850/17850
12	2790	37	C	9/10	PRM / NF	E. Coli / neg	No	0.7/1.1	Neg	19750/14200
13	3850	39	C	9/10	PRM / NF	E. Coli / neg	Lethargy, hypotonic, distress	0.88/2.3	neg	24500/28750

UCBC: umbilical chord blood culture, PBC: peripheral blood culture, CRP: C reactive protein, GA: gestational age, CSF: cerebroespinal fluid culture, WBC: white blood cells, D: vaginal delivery, C: cesarean, K: Kiwi, V: vakuum

In the others 17 newborns there did not growthing in blood cultures after 5 days. Nobody have clinical or analitic changes and they was discharges from hospital agree of center´s rules. (Table 3)

Figure 3

Table 3: Data of patients with negative blood culture

Birth weight	GA	Type of birth	Apgar		CRP	WBC
2760-4300	36-41	V: 9 Cst: 8	8/10		0.02-1.2	7250-21250

In our center the umbilical blood culture had a sensibility of 100% (we did not had, in this period, any patient whith sepsis out of the study) and a specificity of 74% with a predictive positive value of 54%

DISCUSSION

Diagnosis of newborn sepsis is based on presence of clinical signs and sintoms that usually can be subtle or not founds with analitical alterations (2,3)

Our study focuses on the near term and term in whom diagnosis represents a challege because in normal circumstances this patient are under parents observation.

Another fact is the each more frecuently short stay at the hospital that in our center is normally between 36-48 hours being checked by pediatrician 1 or 2 times

The adquisition of venous blood samples for blood cultures in newborns can be difficult (11,14). The finding of a negative blood culture frequently influences management (13).

We have reviewed medical literature and we could not found

any similar observation except one report of 1967 (12) in witch an umbilical blood sample was obtained previous to a umbilical venous canalization for a blood exchage but with a different study objective

Bacterial spectrum: The first item to see is the actual bacterial espectrum involves in neonatal sepsis (6) . The pathogens we report are similar to those of reviewed literature with significative number of pathogens not sensible to IAP for GBS. That has been seen in previous reports and give us to review the actual protocols for control of vertical sepsis that has been thougth to control the infections for GBS (8,9)

Volume sample: The volume sample for a correct blood culture recomended is almost of 0,5ml to 1ml. More volume is neccesary to increase the sensibility of blood culture as shown Connell et cols.(11). In this study was noted a significative increase in the number of positive blood cultures when the volume sample was 3 or more milimeters

In clinical practice we know difficulties that it takes; not only by complications in sample extraction and theremore because these patients may be with hemodynamic inestability

Intrapartum antibiotic prophylaxis: Each time is more frecuently an IAP for a SGB in maternal genital tract or urine infection, maternal fever, prolonged rupture of membranes or fetal tachycardia. The antibiotic action difficults bacterial grow in culture mediums. Other face like we can read in the interesting article by Schrag et col. is a numerous percetage of E.coli sensible to GBS IAP, that can take to ginecologists to extent IAP to mothers with urinary tract infections to E.Coli (8).

Time to obtain blood sample. We think that time from born to blood sample extraction is important for this patients because it´s mean more time to antibiotic effect. We take an umbilical blood sample inmediatly in the delivery room. And we know that bacterial concentration is more important in this case(11,13,14,15)

Time to treatment: With this strategy we can obtain laboratory results in the first 24 hours of life than meens an early diagnosis and treatament with a better outcome (10)

CONCLUSIONS

Neonatal sepsis is a serious illnes with a significant cause of mortality and morbidity and an early treatment influences prognosis.

Owning to a scarce time to newborn observation; usually made by parents, an actually infection strategies aim to control SGB infection and if we have an illnes that can has subtle initial sings we devise a new strategy to obtaining precocious results previous to a significantly clinical alterations .

Blood culture obtained from a umbilical chord sample has been shown in our center as a good way to increase ehtiological diagnosis of sepsis

Nevertheless is neccesary more accuracy studies to stablish which prenatal risk factors must take to obtain an umbilical chord blood simple an what is the correct way to control this patients

References

1. Heath PT, Balfour G, Weisner AM, et al. Group B Streptococcus Working Group. Group B streptococcal disease in UK and Irish infants younger than 90 days. Lancet 2004; 363: 292–4.
2. Berardi A, Lugli L, Rossi L, Morini MS,Vagnarelli F, Ferrari F. Group B streptococcus and preventive strategies in Europe. Arch Dis Child Fetal Neonatal Ed. 2008;93:F249
3. Trijbels-Smeudelrs M, de Jonge GA, Pasker-de Jong PC, Gerards LJ, Adriaanse AH, van Lingen RA, Kollée LA. Epidemiology of neonatal group B streptococcal disease in the Netherlands before and after introduction of guidelines for prevention. Arch Dis Child Fetal Neonatal Ed. 2007. Jul; 92(4): F271-276.
4. Velaphi S, Siegel JD, Wendel GD Jr, Cushion N, Eid WM, Sanchez PJ. Early-Onset Group B Streptococcal Chemoprophylaxis Strategy. Pediatrics 2003;111:541-547
5. Hakansson S, Källén K. Impact and risk factors for early-onset group B streptococcal morbidity: analysis of a national, population-based cohort in Sweden 1997-2001. BJOG 2006 Dec;113 (12): 1452-1458.
6. Garges HP, Moody MA, Cotton M, Smith PB, Tiffany KF, Lenfestey R, Li JS, Fowler VG. Neonatal meningitis: What is the correlation among cerebrospinal fluid cultures, blood cultures and cerebrospinal fluid parameters. Pediatrics 2006; 117: 1094-1100
7. Reyna-Figueroa J, Yuri-Toala E, Ortiz-Ibarra FJ, Rodriguez-Ramirez E, Limón-Rojas AE. Disparity in the criteria for including patients with neonatal sepsis in scientific medical studies.Are we swimming in a sea without limits?. An Pediatr (Barc). 2006;65 (6): 536-540
8. Schrag SJ, Hadler JL, Arnold KE, Martell-Cleary P, Reingold A, Schuchat A.. Risk factors for invasive, early-onset Escherichia coli infections in the era of widespread intrapartum antibiotic use. Pediatrics 2006;118: 570-576
9. Bertini G, Dani C, Cianciulli D, Rubaltelli FF, Nicoletti P. A trial of preventing early- and late-onset Group B streptococcal sepsis with combined intrapartum chemoprophylaxis and universal neonatal screening. J Perinat Med 2006;34(5): 420-424
10. Carbonell-Estrany X, Figueras-Aloy J, Salcedo-Abizanda S, de la Rosa-Fraile M, Castrillo Study Group. Probable early-onset group B streptococcal neonatal sepsis: a serious clinical condition related to intrauterine infection. Arch Dis Child Fetal Neonatal Ed. 2008;93:F85-F89
11. Connell TG, Rele M, Cowley D, Buttery JP, Curtis N. How reliable is a negative blood culture result? Volume of

blood submitted for culture in routine practice in a Children's Hospital. Pediatrics 2007;119:891-896
12. Lipsitz P, Cornet JA. Blood cultures from the umbilical vein in the newborn infant. Pediatrics 1960;26;657-660
13. St Geme JW, Bell LM, Baugmgart S, D'Angio CT, Harris MC. Distinguishing sepsis from blood culture contamination in young infants with blood cultures growing coagulase-negative satphylococci. Pediatrics 1990;86:157-162
14. Knudson RP, Alden ER. Neonatal heelstick blood culture. Pediatrics 1980;65:505-507
15. García-Prats JA, Cooper TR, Schneider VF, Stager ChE, Hansen ThN. Rapid detection of microorganisms in blood cultures of newborn infants utilizing an automated blood culture system. Pediatrics 2000;105: 523-527

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