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Association of Positive Ureaplasma in Gastric Fluid with Clinical Features in Preterm Infants

Yu Jin Jung, M.D.

Department of Pediatrics, Kosin University Gospel Hospital, Busan, Korea

Purpose: The purpose of the present study was to determine the association of positive *Ureaplasma urealyticum* in gastric fluid with clinical features and outcomes in preterm infants.

Methods: Gastric fluid from the preterm infants was first aspirated within 30 minutes and cultured within 24 hours after birth to check for *U. urealyticum*. Infants were divided into two groups on the basis of the presence/absence of *U. urealyticum*.

Results: *U. urealyticum* in gastric fluid was identified in 17 of 91 (19%) preterm infants. Compared with the negative *U. urealyticum* group, there were significantly higher percentage of infants with gestational age ≤ 30 weeks ($P=0.020$), higher Apgar score at 1 minute and 5 minutes ($P=0.017$ and $P=0.048$, respectively), and higher rate of vaginal delivery ($P=0.000$) in the positive *U. urealyticum* group. Although the incidence rate of bronchopulmonary dysplasia between the two groups was not different, the frequency of bronchopulmonary dysplasia without previous respiratory distress syndrome was significantly higher in the positive group (11%) than that in the negative group (1%) ($P=0.030$).

Conclusion: The detection of *U. urealyticum* in gastric fluid is more frequent in infants with gestational age ≤ 30 weeks. It can be helpful to predict the development of bronchopulmonary dysplasia without previous respiratory distress syndrome in preterm infants.

Key Words: Preterm infant, *Ureaplasma urealyticum*, Bronchopulmonary dysplasia

Introduction

Preterm birth (gestational age < 37 weeks; birth weight $< 2,500$ g) is the most common risk factor for infants morbidity and mortality¹⁾. Perinatal infection may play an important role in premature birth¹⁾. *Ureaplasma urealyticum* can be found in the genital tract of 40–80% of pregnant women^{1–4)}. Embree et al.⁵⁾ isolated *U. urealyticum* from 32% of placentas of infants ≤ 38 weeks of gestation. *U. urealyticum* has been associated with neonatal outcomes and complications of pregnancy. Especially, it is highly related with maternal chorioamnionitis^{1,6,7)}. Previous studies have

presented data on the relationship between the presence of *U. urealyticum* and gestational age and/or birthweight^{3,4,8,9)}.

Miralles et al.¹⁰⁾ reported that the presence of microbes in the gastric fluid at birth was strongly interrelated with the occurrence of chorioamnionitis (CAM). Assuming that gastric fluid is in contact with the amnionitic fluid, the presence of *U. urealyticum* in gastric fluid reflects that amnionitic fluid was infected with *U. urealyticum*. This can be explained by the fact that the fetus swallows amniotic fluid while in the uterus. It is considered that the presence of *U. urealyticum* in gastric fluid in preterm infants can be the predictor of maternal chorioamnionitis.

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Correspondence to: Yu Jin Jung, M.D.

Department of Pediatrics, Kosin University Gospel Hospital, 34 Amnam-dong, Seo-gu, Busan 602-702, Korea
Tel: +82-51-990-3336, Fax: +82-51-990-3005, E-mail: hasaohjung@hanmail.net

The aim of the present study was to evaluate whether the detection of *U. urealyticum* in gastric fluid is closely related to the clinical features and outcomes of preterm infants and to the presence of maternal chorioamnionitis.

Materials and Methods

1. Study design

One hundred eighty five infants born at ≤ 37 weeks of gestation had been admitted to the Neonatal Intensive Care Unit (NICU) of Kosin University Gospel Hospital from March 2009 to March 2010. Six infants were not enrolled because they had been born in other hospitals. Eighty two infants had no gastric sample collection because there had not been any gastric fluid to aspirate or the aspiration itself had not been tried. Six of the remaining 97 infants were excluded from the study: five died of necrotizing enterocolitis and one had been transferred because of persistent pulmonary hypertension of newborn. So, the remaining 91 preterm infants whose gastric juice had been taken at birth were included in the study (Fig. 1). All of them were discharged alive.

Gastric aspirates were obtained for culture of *U. urealyticum* on admission after birth. Gastric specimens were aspirated within the first 30 minutes and cultured within 24 hours after birth to avoid nosocomial contamination. Gastric samples were aspirated at birth using a sterile syringe via a

nasogastric or orogastric tube inserted into the stomach, which is a routine general practice for preterm infants of the unit to check the condition of gastric fluid. A nasogastric tube is needed for feeding preterm infants who cannot swallow or suck and have unstable respiratory symptoms such as tachypnea or apnea. Therefore, samples of *U. urealyticum* were obtained using a standard technique that was non-invasive and a usual service protocol. The aspirated samples were immediately transferred to the laboratory. *U. urealyticum* was cultured and identified using Mycoplasma IST 2 (Biomerieux, France)¹¹⁾. Data were collected from the medical records of the infants and their mothers, and were reviewed retrospectively. The infants were divided into two groups: the positive group (n=17) with the growth of *U. urealyticum* from gastric aspirate specimen and the negative group (n=74) with no *U. urealyticum* growth result. The study was reviewed and approved by the Institutional Review Board of the Kosin University Gospel Hospital in 2011 (No. 11-08).

2. Patients

The medical records were reviewed retrospectively to investigate if gastric results for *U. urealyticum* were related with the clinical features and outcomes of preterm infants, and maternal factors. Maternal factors included the mode of delivery, antenatal steroids, premature rupture of membranes (PROM), clinical CAM, intrapartum antibiotics, gestational diabetes mellitus (GDM), pregnancy induced hypertension (PIH), and in vitro fertilization (IVF). PROM was defined as the rupture of the chorioamniotic membrane >24 hours before delivery. CAM was diagnosed clinically if the mother had fever $\geq 38^{\circ}\text{C}$ or C-reactive protein was positive. Neonatal factors included gestational age, birthweight, sex, Apgar score at 1 minute and 5 minutes, length of stay in hospital, and multiple births. The following factors were considered as confirmation that the presence of gastric *U. urealyticum* affected the clinical features and outcomes of the preterm infants: (1) pH and PCO_2 at birth; (2) duration of mechanical ventilation, length of aminophylline for apnea of prematurity, dexamethasone treatment to wean off the

Fig. 1. Summary of eligible enrolled and analyzed subjects. Abbreviations: GA, gestational age; NEC, necrotizing enterocolitis; PPHN, persistent pulmonary hypertension of newborn.

ventilator, and use of indomethacin for treating patent ductus arteriosus (PDA); (3) percentage and day of maximal weight loss, day of recovery to birthweight, day of full feeding, and duration of total parenteral nutrition (TPN); and (4) respiratory distress syndrome (RDS), development of bronchopulmonary dysplasia (BPD), PDA, sepsis, feeding intolerance, retinopathy of prematurity (ROP), intraventricular hemorrhage (IVH), and periventricular leukomalacia (PVL). RDS was defined by the clinical course (tachypnea, intercostal and subcostal retractions, grunting, nasal flaring, and need for oxygen supplementation) and chest x-ray findings of reticulo-granular appearance of lung with air bronchograms. RDS was diagnosed when exogenous surfactant was used as early rescue therapy for infants who met the criteria of respiratory failure ($\text{FiO}_2 > 0.4$ to maintain oxygen saturation at 90% and a diagnosis of RDS). PDA was diagnosed by clinical signs and confirmed by two-dimensional echo evidence of left-to-right shunt through a ductus arteriosus and was managed with fluid restriction and indomethacin treatment. BPD was defined according to the criteria made by Jobe¹²⁾ and jaundice was diagnosed by clinical practice guideline which was provided by Subcommittee on Hyperbilirubinemia of the American Academy of Pediatrics (AAP) in 2004¹³⁾. Preterm infants with ROP $\geq$ stage 3 were included and were diagnosed through the international classification of ROP. IVH $\geq$ Grade 3 (per J. Volpe) was defined by IVH with ventricular dilatation and PVL was diagnosed by brain ultrasound or magnetic resonance imaging (MRI).

3. Statistical analyses

Data were analyzed with PASW version 18.0 (IBM, Somers, NY, USA) software. Parametric data were evaluated by Chi-square test or Fisher exact test and continuous variables were compared by Student's t-test or Mann-Whitney test. Binary logistic regression was used to explain the odds ratio of significant factors. $P < 0.05$ was considered to be significant.

Results

1. Clinical features

Ninety one preterm infants investigated for *U. urealyticum* from gastric fluid had a median gestational age of 31 weeks and median birthweight of 1,586 g. *U. urealyticum* was identified from gastric specimens in 17 infants (19%) and 74 (81%) were negative for *U. urealyticum*. The mean gestational age and mean birthweight of the positive group was 29.8 ± 2.71 weeks and $1,490 \pm 585$ g, respectively. The mean gestational age and mean birthweight of the negative group

Table 1. Demographic Data of Preterm Infants and Their Mothers Studied by the Presence of *U. Urealyticum* in Gastric Fluid

	Positive group (n=17)	Negative group (n=74)	P-value
Gestational age (weeks), mean $\pm$ SD	29.8 $\pm$ 2.71	31.3 $\pm$ 2.92	0.066
, median (range)	29.6 (25.7-34.1)	31.6 (25.4-36.7)	0.075
Gestational age less than 30 weeks, n (%)	9 (52)	18 (24)	0.020
Birthweight (g), mean $\pm$ SD	1,490 $\pm$ 585	1,607 $\pm$ 502	0.402
, median (range)	1,320 (805-2,655)	1,600 (710-3,050)	0.338
Birthweight distribution (g), n (%)			
<750	0 (0)	1 (1)	1.000
750-999	4 (24)	10 (14)	0.288
1,000-1,499	5 (29)	23 (31)	0.893
$\geq 1,500$	8 (47)	40 (54)	0.602
Male gender, n (%)	10 (58)	38 (51)	0.578
Apgar score			
at 1 minute, median (range)	7 (3-8)	6 (2-9)	0.017
at 5 minutes, median (range)	8 (8-9)	8 (4-9)	0.048
Length of hospital stay (days)	56 $\pm$ 32.1	42 $\pm$ 26.5	0.061
Multiple births, n (%)	3 (17)	24 (32)	0.229
Vaginal delivery, n (%)	13 (76)	16 (21)	0.000
Antenatal steroids, n (%)	13 (76)	45 (60)	0.226
PROM (>24 h), n (%)	6 (35)	19 (25)	0.547
CAM, n (%)	4 (23)	8 (10)	0.227
Intrapartum antibiotics, n (%)	10 (58)	36 (48)	0.449
GDM, n (%)	1 (5)	5 (6)	1.000
PIH, n (%)	1 (5)	7 (9)	1.000
IVF, n (%)	0 (0)	11 (14)	0.090

Abbreviations: PROM, premature rupture of membranes; CAM, chorioamnionitis; GDM, gestational diabetes mellitus; PIH, pregnancy induced hypertension; IVF, in vitro fertilization.

Table 2. Effects of Variables by the Presence of *U. Urealyticum*

	Positive group (n=17)	Negative group (n=74)	Odds ratio	95% Confidence interval	P- value
Gestational age <30 weeks, n (%)	9 (52)	18 (24)	3.5	1.176-10.414	0.020
Vaginal delivery, n (%)	13 (76)	16 (21)	11.78	3.376-41.115	0.000

was 31.3 ± 2.92 weeks and $1,607 \pm 502$ g, respectively. Each of the results was significantly different. The percentage of the infants with gestational age ≤ 30 weeks was significantly higher in the positive group than that in the negative group. The difference between the two groups was statistically significant ($P=0.02$) (Tables 1 and 2). Apgar scores at 1 minute and 5 minutes were statistically higher in the positive group than those in the negative group ($P=0.030$ and $P=0.045$, respectively) (Table 1). The preterm infants in the positive group stayed longer in the NICU than those in the negative group, but this did not reach statistical significance (Table 1). The percentage of vaginally delivered infants was 76% (13/17) in the positive group and 21% (16/74) in the negative group, each of which was statistically different ($P=0.000$) (Tables 1 and 2). The pH at birth was similar in the two groups. But the PCO_2 at birth of the positive group was significantly higher than that of the negative group ($P=0.023$) (Table 3). The duration of aminophylline therapy for apnea of prematurity was longer in the positive group than that in the negative group ($P=0.013$). The infants with positive *U. urealyticum* required more time to reach a birthweight after physiologic weight loss than those with negative *U. urealyticum* ($P=0.043$).

2. Clinical outcomes

The incidence rate of BPD was higher in the positive group (29%) than that in the negative group (13%), but the difference was statistically insignificant ($P=0.146$). The severity of BPD, as defined by mild, moderate, and severe, was not statistically significant between the two groups (Table 4). But, three of 17 (17%) infants in the positive group had oxygen supplement or ventilator requirement at 36 weeks post-conceptional age, whereas only three of 74 (4%) infants in the negative group had them ($P=0.042$). The incidence of BPD without previous RDS was higher in the

Table 3. Clinical Features of Preterm Infants Studied by the Presence of *U. Urealyticum* (mean $\pm$ SD)

	Positive group (n=17)	Negative group (n=74)	P- value
pH at birth	7.26 $\pm$ 0.09	7.26 $\pm$ 0.10	0.988
PCO_2 at birth	54 $\pm$ 11.4	47 $\pm$ 13.3	0.023
Time on mechanical ventilator (days)	6.0 $\pm$ 12.59	4.6 $\pm$ 9.86	0.702
Duration of AMP (days)	31.9 $\pm$ 32.32	17.4 $\pm$ 23.43	0.013
Dexamethasone therapy, n (%)	2 (11)	4 (5)	0.311
Indomethacin therapy, n (%)	4 (23)	21 (28)	0.772
Maximal weight loss (%)	13.1 $\pm$ 6.67	11.5 $\pm$ 5.17	0.534
Day of maximal weight loss (day)	6.2 $\pm$ 1.82	5.4 $\pm$ 1.96	0.067
Day of recovery to birthweight (day)	17.1 $\pm$ 6.87	14.0 $\pm$ 5.27	0.043
Day of full feeding (day)	23.6 $\pm$ 12.63	23.0 $\pm$ 15.18	0.579
Duration of TPN (days)	21.1 $\pm$ 12.54	20.4 $\pm$ 16.11	0.488

Abbreviations: AMP, aminophylline; TPN, total parenteral nutrition.

Table 4. Outcomes of Preterm Infants Studied by the Presence of *U. Urealyticum* (mean $\pm$ SD)

	Positive group (n=17)	Negative group (n=74)	P- value
RDS at birth, n (%)	4 (23)	22 (29)	0.769
BPD, n (%)	5 (29)	10 (13)	0.146
mild, n (%)	3 (17)	7 (9)	0.389
moderate, n (%)	2 (12)	2 (3)	0.157
severe, n (%)	0 (0)	1 (1)	1.000
BPD without previous RDS, n (%)	2 (11)	1 (1)	0.030
Symptomatic PDA, n (%)	3 (17)	14 (18)	1.000
Oxygen or ventilator requirement at 28 days of age, n (%)	4 (23)	11 (14)	0.468
Oxygen or ventilator requirement at 36 weeks, n (%)	3 (17)	3 (4)	0.042
Sepsis, n (%)	3 (17)	11 (14)	0.721
Feed intolerance, n (%)	5 (29)	32 (43)	0.295
ROP $\geq$ stage 3, n (%)	0 (0)	3 (4)	1.000
IVH $\geq$ grade 3, n (%)	0 (0)	2 (2)	1.000
PVL, n (%)	0 (0)	4 (9)	0.569

Abbreviations: RDS, respiratory distress syndrome; BPD, bronchopulmonary dysplasia; PDA, patent ductus arteriosus; ROP, retinopathy of prematurity; IVH, intraventricular hemorrhage; PVL, periventricular leukomalacia.

positive group compared with the negative group (2/17, 11% versus 1/74, 1%, respectively; $P=0.03$). The gestational age of two infants with BPD without previous RDS in the positive group was 28⁺² weeks and 28⁺⁵ weeks respectively, whereas that of an infant in the negative group was 30⁺¹ weeks.

Discussion

Ureaplasma infection of the chorioamnion has been strongly associated with chorioamnionitis, premature birth, and perinatal morbidity and mortality^{1,2,14}. Antenatal infection such as chorioamnionitis with *U. urealyticum* is related with the outcomes of preterm infants^{15,16}. In the past, gastric aspirate microscopy and culture were used routinely to help in the diagnosis of neonatal sepsis¹⁷. An advantage of the gastric aspirates as a specimen for culture is that it represents the flora of the birth canal and amniotic fluid¹⁷. Therefore, it could indicate that the presence of the organisms in gastric fluid of preterm infants is associated with maternal chorioamnionitis. In addition, the analysis of gastric aspirate samples is considered to be a possible and practical method to identify pathogens that a neonate may have been exposed to in the uterus. In the present study, the presence of *U. urealyticum* in gastric fluid may well be a factor in the clinical features and outcomes of preterm infants. The presence of *U. urealyticum* was identified using Mycoplasma IST 2, which is a complete kit for the diagnosis of *U. urealyticum* and *Mycoplasma hominis*. The strips included in the kit can conclusively establish the presence or absence of *U. urealyticum* and *M. hominis*, can enumerate each organism at a colony forming unit $\geq 10^4$, and provide information concerning antibiotic susceptibilities to doxycycline, josamycin, ofloxacin, erythromycin, tetracycline, ciprofloxacin, azithromycin, clarythromycin, and pristinamycin. However, *Mycoplasma* IST 2 is limited; if the specimen titer is low, the strip cupules may not change color or, the color change may be inconsistent.

The 19% incidence of positive results for *U. urealyticum* in the present study was low, compared with the result of previous studies which varied between 33% and 55% of

clinical samples^{18,19}. But, the present rate is similar to the 15% and 18% reported elsewhere^{20,21}. In another study²², the mean gestational age and birthweight of infants with positive *U. urealyticum* results were lower than those with negative results. Also, van Waarde et al.⁴ reported that *U. urealyticum* is often associated with gestational age and/or low birth weight. But, in other studies, there were no differences in gestational age and birthweight between *U. urealyticum* positive and negative infants^{21,23}. Presently, the mean gestational age and birthweight of infants in the positive group was less than those of the negative group, but this did not reach statistical significance. These discrepancies may be related to differences in the populations of infants studied. Goldenberg et al.²⁴ mentioned that intrauterine infection can be regarded as a major cause of preterm birth, especially in gestations of under 30 weeks. Similarly, van Waarde et al.⁴ reported that the percentage of preterm infants ≤ 30 weeks in the *U. urealyticum* cultured group (61%) was much higher than that in no cultured group (35%). As in these two studies, the present study showed that the percentage of infants with gestational age ≤ 30 weeks in the positive group was 3.5 times higher than that in the negative group (Table 2). However, comparing the incidence rate of RDS and BPD in infants with gestational age ≤ 30 weeks revealed no significant difference between the two groups. In one study, a significantly higher number of babies weighing $<1,000$ g was colonized compared with babies weighing $>1,000$ g¹. This association between increased colonization rate and decreased birthweight has been reported by others^{8,25}. But, when 91 preterm infants were evaluated separately in the present study by analyzing after division into birthweight-based subgroups (<750 g, 750–999 g, 1,000–1,499 g, and $\geq 1,500$ g), the presence of *U. urealyticum* showed no significant association with birthweight. Apgar scores at 1 minute and 5 minutes achieved statistical reliability between the two groups. *U. urealyticum* can be isolated from amniotic fluid as early as 16–20 weeks of gestation and has been implicated in spontaneous abortion^{1,2}. However, if a fetus infected with *U. urealyticum* is not aborted early, the fetus could have had host immune factors

affecting insusceptibility to this pathogen. Considering the above assumption, the Apgar score can be higher in the positive *U. urealyticum* group. Even though there was no significant difference in this study, preterm infants with positive *U. urealyticum* did stay longer in NICU. This result may have reflected the previous observation that the perinatal colonization of prematurity is associated with a prolonged NICU stay^{2,8)}.

The effect of the mode of delivery on the rate of colonization is controversial²⁵⁾. Sánchez³⁾ did not find that mode of delivery affected the vertical transmission rate. In contrast, Payne et al.²¹⁾ and Iwasaka et al.²⁶⁾ found that vertical transmission of infants delivered vaginally was significantly higher than that of those born by caesarean section. The present study demonstrates that the percentage of the preterm infants born by vaginal delivery was significantly higher in the positive group than that in the negative group. This observation was supported by the fact that *U. urealyticum* can be transmitted from a colonized woman to her newborn infant at delivery through a colonized birth canal^{2,3)}. Abele-Horn et al.⁹⁾ reported that *U. urealyticum* at birth was associated with a significantly increased rate of amnionitis and CAM. However, this study showed that the rate of CAM was not different between the two groups. Unlike most other bacterial infections, *Ureaplasma* infection of the amniotic fluid is subclinical, which is not associated with fever and uterine tenderness. Thus, it may not be a significant cause of clinical amnionitis¹⁾. *Ureaplasma* infection has been described as the pathogen for orchitis, epididymitis, spermatoctitis, prostatitis and urethritis²⁾. The incidence of genital *ureaplasma* infections for infertile couples is twice for fertile couples²⁾. Nevertheless, presently, the number of the pregnancies due to in vitro fertilization was 11 in the negative group and none in the positive *U. urealyticum* group. Therefore, it is suggested that the ureaplasma infection does not lower the rate of pregnancy after IVF but lower the rate of pregnancy.

There is no clear evidence to explain the reason that the PCO₂ at birth was higher in the positive group. However, the frequency of diuretics therapy was higher in the positive

group (data not shown). The duration of aminophylline treatment was significantly longer in the positive group than that in the negative group in the present study. These results have led to the search for microbiological causes of respiratory distress in infants requiring medical care for respiratory illnesses. Other studies reported that *U. urealyticum* was isolated from infants not only with infections of the central nervous system or neonatal sepsis^{1,2)} but also with periventricular leukomalacia and intraventricular hemorrhage^{2,27)}. But, in this study the adverse outcomes of preterm infants such as sepsis, IVH, and PVL were not significantly associated with the presence of gastric *U. urealyticum*.

Several investigators have demonstrated that the rate of BPD in infants colonized with *U. urealyticum* is increased^{14,25,28)} and Agarwal et al.²⁵⁾ showed that infants colonized with *U. urealyticum* were twice as likely to develop BPD compared with non-colonized infants. Other investigators, in contrast, concluded that the development of BPD in preterm infants is not associated with *U. urealyticum*^{4,18)}. The difference between the two groups was not statistically significant in the present study, as the latter investigators concluded. Also, the duration of mechanical ventilation in the positive group was similar to that in the negative group. However, infants who had oxygen supplement or ventilator requirement at 36 weeks post-conceptional age in the positive *U. urealyticum* group were significantly more than those in the negative group. This could be because moderate or severe BPD developed in preterm infants with a gestational age ≤ 32 weeks. The incidence of BPD without previous RDS was statistically higher in the positive group compared with the negative group. These differences may have been attributable to the intrauterine infection of colonized infants with *U. urealyticum*. Even if the etiology of BPD is multifactorial, there is increasing evidence of a link with intrauterine infection of *U. urealyticum*¹⁹⁾. Considering that the infants diagnosed as BPD without previous RDS were more in the positive group, the intrauterine infection with *U. urealyticum* contributed to BPD and the result of the gastric *U. urealyticum* was helpful to predict the occurrence

of BPD in preterm infants without previous RDS. However, a limitation of this study is that the number of infants with BPD without previous RDS was small (two infants in the positive group and one infant in the negative group). In addition, these results suggest that increased oxygen requirements of infants with positive *U. urealyticum* might predispose them to lower respiratory tract infection or, alternatively, that *U. urealyticum* infection potentiates oxygen-induced lung injury, even though nasopharyngeal or tracheal specimens for *U. urealyticum* were not examined in the present study.

Further development of therapeutic intervention will be necessary. Two studies have demonstrated that erythromycin did not reduce the incidence or severity of BPD^{20,25)}. But, a study of 14 very low birth weight colonized neonates documented that erythromycin was well-tolerated and had favorable pharmacokinetic activity for *U. urealyticum*²⁹⁾. The present study did not have data about treatment of BPD. So, the usefulness of erythromycin therapy of infants with proven *U. urealyticum* in gastric aspirates in the prevention of BPD will need to be evaluated. Sequencing the genomes of the organisms in gastric fluid will be needed to search for an association of the clinical features and outcomes of preterm infants infected with *U. urealyticum* after the macrolide therapy.

In summary, the presence of *U. urealyticum* in the gastric fluid at birth may be associated with the development of BPD without previous RDS in preterm infants and be more frequently detected in infants with gestational age ≤ 30 weeks. This association needs to be further verified in a larger study.

한글요약

목적: 미숙아에서 위액 내 *Ureaplasma urealyticum*의 검출이 미숙아의 특징과 임상적 예후에 어떤 영향을 주는지를 알아보고자 하였다.

방법: 미숙아를 대상으로 출생 후 30분 이내에 첫 위액은 채취하였고, 위액 내 *U. urealyticum*이 검출되는지를 확인하기 위해 24시간 이내에 배양을 실시하였다. 그리고 *U. urealyticum*이 검출된 군을 양성군으로, 검출되지 않은 군을 음성군으로 나누

었다.

결과: 91명의 미숙아 중에서 17명(19%)에서 위액 내 *U. urealyticum*이 검출되었다. *U. urealyticum* 양성군에서 음성군보다 통계학적으로 30주 미만의 미숙아 수가 더 많았고($P=0.02$), 1분과 5분 아프가 점수가 더 높았으며($P=0.017$ 과 $P=0.048$), 그리고 질식 분만이 더 많았다($P=0.000$). 두 군간에 기관지폐이형성증의 발생률은 차이가 없었지만, 이전에 신생아호흡곤란증 진단 없이 기관지폐이형성증의 발생한 빈도는 음성군(1%)보다 양성군(11%)에서 의미 있게 높았다($P=0.03$).

결론: 위액 내 *U. urealyticum* 검출은 임신 기간 30주 미만 미숙아에서 높게 관찰되고, 미숙아에서 진행되는 신생아호흡곤란증후군이 없이도 발생할 수 있는 기관지폐이형성증을 예측하는데 도움이 된다.

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