

Candida colonization in neonates admitted to neonatal intensive care unit (NICU) in Mosul

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ABSTRACT

Background: *Candida* species are important nosocomial pathogens in the newborns, particularly among the preterms. Colonization of the neonatal skin and gastrointestinal tract is the first step in the pathogenesis of invasive Candidiasis. Colonization of the infant occurs early in life and this is affected by a variety of common practices in the neonatal intensive care unit (NICU).

Objective: To determine colonization of *Candida* species in neonates admitted to NICU in Mosul city, and to identify the possible risk factors for colonization.

Patients and methods: A case series study was conducted in a Al Khansaa Teaching Hospital in Mosul city between September 2012 to March 2013. Fifty neonates who were admitted for several causes and stayed in the hospital for seven or more days were included in the study. Sterile cotton tipped swabs from oral, rectal and umbilical areas of each neonate were collected within 24 hours of admission, day five, day seven or thereafter when the neonate was discharged from hospital. Swabs were smeared on the surface of plates of Sabourauds glucose agar. Data was analyzed using Students "t" test, Chi-square test and Fisher's exact test wherever necessary.

Results: *Candida* colonization was seen in 70% of patients at different sites and times of samples collection. Colonization was more common in males than females. From the colonized neonates, 60% were full term and 40% were premature, and 74% had normal birth weight and 26% had low birth weight. Acquisition of *Candida* occurred in 63% of neonates within the first 24 hrs and by day five 94% of neonates were colonized. The remaining 6% were colonized after fifth days of admission. Male sex, normal birth weight and signs of vaginal candidiasis in the mother were found to be significant risk factors for neonatal colonization.

Conclusion: *Candida* colonization was seen in 70% of the study sample. Male neonates were colonized more often than females. Male sex, normal birth weight and signs of maternal vaginal candidiasis were significant risk factors for neonatal colonization with *Candida*.

Keywords: Candida colonization, neonates, intensive care, Mosul.

مستعمرات المبيضات لدى الأطفال حديثي الولادة الراقدين في وحدة الطفل الخديج في الموصل

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الخلاصة

المقدمة: تعتبر الإصابة بالمبيضات للأطفال حديثي الولادة والخدج من الأمراض المهمة التي قد يصاب بها الطفل في المستشفى. أن تعشش المبيضات في الجلد والجهاز الهضمي يعتبر خطوة أولى لإنتشار الإصابة بالمبيضات إلى بقية أعضاء الجسم.
الأهداف: تهدف هذه الدراسة لمعرفة مدى تعشش المبيضات في الأطفال حديثي الولادة والخدج وكذلك لتحديد عوامل الخطورة للإصابة.

المرضى وطرائق العمل: دراسة تتبعية أجريت في مستشفى الخنساء التعليمي للأطفال للفترة من أيلول/ ٢٠١٢ لغاية آذار / ٢٠١٣. تمت دراسة خمسون طفلاً أدخلوا لوحدة الطفل الخديج أثناء تلك الفترة لأسباب مرضية مختلفة ويقوا في المستشفى لمدة سبعة أيام أو أكثر. تم أخذ مسحات لغرض زرع المبيضات من فم وقاعدة السرة والجهاز الهضمي لجميع المرضى خلال اليوم الأول للدخول، اليوم الخامس واليوم السابع أو عند خروج المريض وأرسلت العينات الى المختبر لغرض الزراعة.

النتائج: لوحظ أن ٧٠% من الأطفال مصابين بتعشش المبيضات في أنحاء مختلفة من الجسم، وإن الأطفال الذكور معرضين للإصابة أكثر من الإناث كما لوحظ أن نسبة الإصابة للأطفال مكتملي النمو ٦٠% بينما إصابة الأطفال غير مكتملي النمو بلغت ٤٠%. كما لوحظ أن نسبة الإصابة للأطفال الذين كانت أوزانهم كاملة (٢,٥ كيلوغرام أو أكثر) بلغت ٧٤%. إكتسب ٦٣% من الأطفال الإصابة خلال ٢٤ ساعة الأولى من دخول المستشفى، و ٩٤% خلال الأيام الخمسة الأولى والباقي ٦% بعد اليوم الخامس للدخول. أظهر البحث أن عوامل الخطورة كانت الأطفال الذكور وزن الولادة ٢,٥ كيلوغرام أو أكثر ووجود أعراض لإصابة الأم بمبيضات المهبل أثناء الحمل.

الاستنتاج: كانت نسبة إصابة الأطفال المشاركين بالبحث بتعشش المبيضات ٧٠%، الأطفال الذكور معرضين للإصابة أكثر من الإناث. أما عوامل الخطورة للإصابة بالمرض فهي الطفل الذكر، الوزن الكامل أثناء الولادة ووجود أعراض لإصابة الأم الحامل بمبيضات المهبل.

الكلمات المفتاحية: مستعمرات المبيضات، أطفال حديثي الولادة، وحدة العناية المركزة، الموصل.

INTRODUCTION

Candida species are significant nosocomial microorganism in the neonate, especially in the preterm. The first step in *Candida* invasion is colonization of the gastrointestinal tract (GIT) and skin of neonates.¹ *Candida albicans* is the commonest detected species in colonized or infected neonates. During the last years colonization and infection with other candida species has increased dramatically especially among premature infants.^{2,3} This has been attributed to the use and duration of broad spectrum antibiotics therapy,⁴ technology advancement of life supporting systems, relative immunodeficiency in the neonates,^{5,6} colonization of maternal vagina and *Candida* ability to live on environmental surfaces.⁷

Infant colonization by candida occurs early in life due to routine daily works in the neonatal intensive care unit (NICU). Neonatal fungal infections are associated with substantial mortality and morbidity.⁸

Risk factors of *Candida* colonization or infection are preterm neonates who need invasive and aggressive diagnostic and therapeutic procedures, congenital anomalies, prior antibiotic therapy, necrotizing enterocolitis and gastrointestinal tract diseases. Prior colonization is the major risk factor for candida infection.⁹

Most neonatal candidiasis is endogenously acquired through prior colonization of different parts of the neonatal body. Other studies

suggested that some outbreaks of candidiasis were caused by nosocomial infection in NICU.¹⁰

In general, the first step towards severe infection is *Candida* colonization, which lives as normal flora in the intestine.¹¹⁻¹³ Actually, Wey et al¹⁴ during the 1980s, recognized *Candida* colonization as an independent risk factor for candidemia. In fact, colonization of multiple sites is an important risk factor for invasive fungal infection in severely ill neonates and the density of colonization could be a predictive value for the diagnosis of systemic candidiasis,¹⁵⁻¹⁷ indeed its difficult to recognize between infection and colonization.¹⁸ *Candida* colonization can present in 5–50% of neonates and an invasive infection can develop in 5–30% of colonized patients.^{19,20} The death risk in neonates with distinct *Candida* colonized body sites is similar to that of neonates with proven invasive infection.²⁰

Aim of the study:

- 1- To determine colonization of *Candida* species in neonates admitted to NICU in Mosul city.
- 2- To detect the possible colonization risk factors.

PATIENTS AND METHODS

A case series study was conducted at Al Khansaa Teaching Hospital in Mosul city in the period from September 2012 to March 2013. A total of 50 neonates (premature and full term) who were admitted for several causes and stayed in the

hospital for 7 or more days were included in the study. All of them were kept in incubators and received antibiotics (ampicillin and aminoglycosides or ampicillin and third generation cephalosporin).

Specimens collection: Swabs from rectal, oral and umbilical areas of each neonate were collected within 24 hours of admission, 5th, 7th day or after that when the patient was discharged from hospital.

Collection of samples were done by using sterile cotton swabs after moistening them with sterile saline and all samples were processed to the laboratory within 30 minutes of collection. Swabs were smeared on the surface of plates of Sabourauds glucose agar which were incubated for 48 hours at 37 C°. All samples that yielded yeast colonies were proceeded further for the identification of *Candida* species and positive results were indicated by positive Germ tube test &/or API *Candida* test (Biomieux).

Collection of blood samples from the neonate and vaginal swabs from the mother were not part of the study.

In neonates, information about I) intake of antibiotics, steroids, blood transfusion or exchange, II) type of feeding III) associated disease or anomaly, IV) birth weight, and V) sex, were recorded. And in mothers I) site of delivery, II) gestational age, III) type of delivery, IV) duration of rupture of membrane, V) signs of vaginal candidiasis, and meconium stained liquor were noted and recorded.

Data was analyzed using Students "t" test, Fisher's exact test and Chi-square test wherever necessary.

RESULTS

The total number of patients included in the study was 50, (28 males and 22 females). *Candida* colonization was seen in 35 (70%) of the patients at different sites and times of samples collection.

Table 1 showed the characters of colonized neonates. Colonization was detected in 23 (65%) males and 12 (35%) females with male: female ratio of 1.9:1. From the colonized neonates, 21 (60%) were full term and 14 (40%) were premature. Twenty six (74%) of the colonized neonates had normal birth weight while 9 (26%) had low birth weight.

Table 2 showed the date and site of colonization. Among the colonized neonates acquisition of *Candida* occurred in 63% of them within the first 24 hrs and by day five 94% of neonates were colonized. The remaining 6% were colonized after fifth days of admission.

Regarding site of colonization, colonization of one site was seen in 19 (54%) of patients, and in two sites were seen in 16 (46%) of patients. The maximum colonization was in the mouth (66%) followed by the rectum (57%) and the umbilicus (20%). However earliest colonization i.e., within 24 hrs was that of the umbilicus (71%).

Table 3 showed the risk factors that lead to *Candida* colonization, it is clear from this table that male sex, normal birth weight and signs of vaginal candidiasis in the mother were found to be significant risk factors. However colonization in neonates was seen more frequently in those with normal vaginal delivery, non-breast milk feeding and delivery at hospital, but the differences were not statistically significant.

Table 1. Characters of colonized neonates.

Patents character	No= 35 (100%)
♀	12 (35%)
♂	23 (65%)
Full term	21 (60%)
premature	14 (40%)
LBW	9 (26%)
NBW	26 (74%)

Table 2. Date and site of colonization.

Colonization	Time			Total
	24 hr	5 days	>5 days	
Number of colonization	22 (63%)	11 (31%)	2 (6%)	35
Cumulative colonization	22 (63%)	33 (94%)	35 (100%)	-
Mouth	13 (57%)	7 (30%)	3 (13%)	23 (66%)
Umbilicus	5 (71%)	2 (29%)	0 (0%)	7 (20%)
Rectum	12 (60%)	7 (35%)	1 (5%)	20 (57%)

Table 3. Risk factors for Candida colonization.

Factor	Candida positive n=35		Candida negative n=15	
	No.	%	No.	%
1-Gestational age				
premature	14	(40)	10	(66.7)
full term	21	(60)	5	(33.3)
2-Birth weight				
≥2.5 kg	26	(74)*	6	(40)
<2.5 kg	9	(26)	9	(60)
3-sex				
Male	23	(65)*	5	(33.4)
Female	12	(35)	10	(66.6)
4-Mode of delivery				
NVD	19	(54)	13	(87)
CS	16	(46)	2	(13)
5-PROM				
Yes	10	(29)	5	(33.4)
no	25	(71)	10	(66.4)
6-Use of steroid				
Yes	5	(15)	3	(20)
no	30	(85)	12	(80)
7-Meconium aspiration				
Yes	14	(40)	4	(27)
no	21	(60)	11	(73)
8-Signs of vaginal candidiasis				
Yes	24	(69)*	14	(93.4)
no	11	(31)	1	(6.6)
9-Mode of feeding				
Breast	7	(20)	7	(47)
Others	28	(80)	5	(53)
10-Place of delivery				
Home	8	(22)	3	(20)
Hospital	27	(78)	12	(80)
11-Blood or exchange transfusion				
Yes	8	(23)	3	(20)
No	27	(77)	12	(80)
12-Congenital anomalies				
Yes	12	(34)	3	(20)
No	23	(66)	12	(80)

*P value < 0.05 (statistically significant).

DISCUSSION

Disseminated candidiasis is a significant cause of neonatal morbidity and mortality and candida colonization is the early step in the pathogenesis of invasive candidiasis.¹

Neonatal colonization by *Candida* was 70% in this study, and this is nearly similar to that in Virginia (60%)²¹ but higher than that reported from India (34%)¹ and Italy (18%).²² This variation may be due to difference in intensity of routine antifungal antiseptic measures and difference in the environments.

Colonization of male neonates was more than female in this study, and this is in agreement with a study done in India.¹ Colonization of full term and normal birth weight neonates were more frequent than premature and low birth weight babies in our study and this is different from other studies done in India¹ and North Carolina,²³ which showed no statistical difference between prematurity and birth weight. And this difference may be due to small sample size in our study.

It is noted that neonatal candida colonization occurs during the first few hours of life.^{2, 24} In the present study colonization was recognized within the first 24 hours of admission in 63% of cases.

Oral (66%) and rectal colonization (57%) were the commonest sites and this is comparable to other studies.^{1,25} Colonization of GIT occurs predominantly during the first week of life,^{2,26} and it can serve as a reservoir from where the *Candida* can spread and this may be due to poor local colonization resistance particularly if there is a breach in mucosal lining.²⁷

The significant risk factors observed in our study were signs of vaginal candidiasis in the mothers, male sex and normal birth weight. The frequency of colonization in neonates was higher in those who were delivered normally through vaginal canal than those delivered by Cesarean intervention and the fact that earliest colonization was that of the oral mucosa (probably colonization during vaginal delivery) signifying that mothers with vaginal candidiasis are important source of neonatal candidiasis.¹ Male sex was a significant risk factor in the present study and which is similar to that reported from India.¹ In regard to normal birth weight as a risk factor, found in this study, others did not report similar result.^{1, 28} They showed that low birth weight is a risk factor for neonatal colonization which may be attributed to small sample size in our study.

CONCLUSION

Candida colonization was seen in 70% of the studied neonates. Male neonates were colonized more often than females. Male sex, normal birth weight and signs of maternal vaginal candidiasis were significant risk factors for neonatal colonization with *Candida*.

RECOMMENDATIONS

- 1- Monitoring of *Candida* colonization in hospitalized neonates is an important step to prevent disseminated infection.
- 2- Over use of steroid and antibiotics, should be avoided.
- 3- Screening of all pregnant women for the presence of *Candida*, irrespective of symptoms and treatment of them, is important to decrease colonization and prevent infection of the neonates.

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