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研究課題名（和文）ESBL産生大腸菌の母子感染と乳児に及ぼす影響

研究課題名（英文）Maternal-neonatal transmission of extended-spectrum b-lactamase-producing enterobacteriaceae

研究代表者

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研究成果の概要（和文）：乳幼児への基質拡張型β-ラクタマーゼ産生大腸菌（ESBL-E）感染ルートは明らかになっていない。今回、新生児へのESBL-E感染ルートを明らかにする。
この前向き横断研究では、新生児の便培養 2回（生後4日目と1か月健診）と母親の膣培養を比較検討した。新生児 631例と母親 629例を対象とし、ESBL-Eは新生児 31例（4.9%）、母親 25例（4.0%）から検出された。新生児へのESBL-E感染ルートは、32%が母親からの垂直感染、45%が院内感染、23%が家庭内感染であった。
新生児へのESBL-E感染ルートは、母子感染以外に、院内感染や家庭内感染も重要な感染ルートとなりうる。

研究成果の学術的意義や社会的意義
薬剤耐性菌の増加は世界中で問題となっている。特に基質拡張型β-ラクタマーゼ産生大腸菌（ESBL-E）は、小児において尿路感染症や髄膜炎などの重要な原因菌となっている。これまで乳幼児へのESBL-E感染ルートは明らかになっておらず、主な感染ルートとして母子感染が示唆された。
今回の研究では、新生児期に既に多くのESBL-E感染を認め、母子感染は重要な感染ルートであった。しかし、院内感染や家庭内感染も重要な感染ルートであった。
そのため、新生児へのESBL-E感染を抑制するために、ESBL-Eを保菌する母親への指導、院内感染対策の強化、手指衛生など家庭内での感染対策の強化が重要となる。

研究成果の概要（英文）：The increase in extended-spectrum beta-lactamase (ESBL)-producing Escherichia coli (ESBL-E) has become a global issue. The route of transmission of ESBL-E to infants remain unknown. This study aimed to determine whether ESBL-E can be transmitted from the mother to the neonate.
In this cross-sectional prospective study, we collected rectal samples from neonates who were born with normal gestational age in our hospital from September 2019 to December 2020. We compared the results from the neonatal and maternal cultures. This study included 631 neonates and 629 mothers. Among them, ESBL-E strains were isolated from 31 neonates (4.9%) and 25 pregnant women (4.0%). The ESBL-E transmission rates to the neonates were 32%, 45%, and 23% for the vertical, nosocomial, and household transmissions, respectively.
Maternal carrier status was associated with an increased risk of ESBL-E transmission to the neonates. Nosocomial or domestic transmission is another potential transmission route of ESBL-E.

研究分野：小児感染症

キーワード：基質拡張型β-ラクタマーゼ産生大腸菌　薬剤耐性菌　母子感染　院内感染　家庭内感染

様　式　C－１９、F－１９－１（共通）

１．研究開始当初の背景

The increase in extended-spectrum beta-lactamase (ESBL)-producing Escherichia coli (ESBL-E) has become a global issue. The number of infectious diseases caused by ESBL-E such as urinary tract infection and meningitis has increased in infants. However, it is uncertain when, where, and how ESBL-E is transmitted to infants. Since the ESBL-E carriage rate in pregnant women has increased, one of the estimated routes of ESBL-E transmission is from mother to neonate.

２．研究の目的

This study aims to identify whether the ESBL-E transmission can occur from mother to neonate and its risk factors for ESBL-E transmission.

３．研究の方法

In this cross-sectional prospective study, we collected rectal samples from neonates who were born with normal gestational age in our hospital from September 2019 to December 2020. Two samples were obtained from each neonate, day 5 and one month after the birth. In Japan, vaginal-rectal samples are routinely obtained from pregnant women at around 34 gestational weeks for screening of Group B streptococcus. We compared the results from the neonatal and maternal cultures. Logistic analyses were performed to identify potential risk factors for the transmission of ESBL-E.

４．研究成果

1. Prevalence of ESBL-E colonization

The study included 631 neonates and their 629 mothers. ESBL-E strains were isolated from 31 out of 631 (4.9%) neonates. Of them, 21 out of 31 (68%) neonates were already ESBL-E carriers/colonization on day 5 (Fig.1). All of them remained ESBL-E carriers at one month. The rest of 10 (32%) neonates were carriers for the first time at one month.

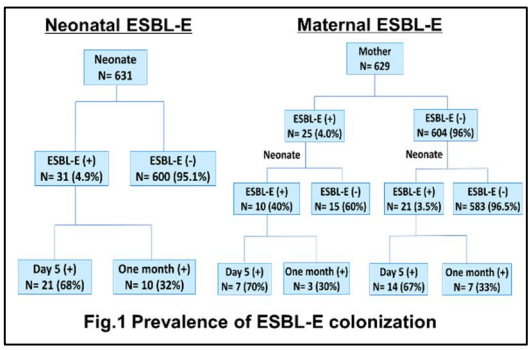

Fig.1 Prevalence of ESBL-E colonization

ESBL-E strains were isolated from 25 out of 629 (4.0%) pregnant women between 34 and 36 gestational weeks. Of their 25 neonates, ESBL-E were isolated from 10 (40%) neonates. Of them, 7 out of 10 (70%) neonates carried at day 5, and 3 out of 10 (30%) neonates carried at one month. The ESBL-E transmission rate from mother to neonate was estimated 40% (10/25 cases). Whereas, among 21 neonates who had ESBL-E but whose mothers did not, ESBL-E were isolated from 14 out of 21 (67%) neonates at day 5, and 7 out of 21 (33%) neonates at one month.

2. Risk factors for ESBL-E transmission

The risk factors for the transmission of ESBL-E in univariable logistic analysis showed in Table 1. The compared risk factors included maternal ESBL-E carriage, vaginal delivery, past delivery, PROM, breast feeding, living with siblings, living with grandparents. Maternal ESBL-E carriage was an independent risk factor for ESBL-E transmission. The risk factors for the transmission of ESBL-E in multivariable logistic analysis showed in Table 2. The risk factors for the transmission of ESBL-E were maternal ESBL-E carriage [OR 19.591, 95%CI (7.271-52.786), p<0.001], vaginal delivery [OR 1.586, 95% CI (0.604–4.165), p=0.349], past delivery [OR 0.146, 95% CI (0.024–0.889), p=0.037], PROM [OR 0.137, 95% CI (0.016–1.150), p=0.067], breast feeding [OR 0.904, 95% CI (0.113–7.236), p=0.924], siblings [OR 3.779, 95% CI (0.650–21.954), p=0.139], and grandparents [OR 2.454, 95% CI (1.047–5.754), p=0.039]. Maternal ESBL-E carriage and living with grandparents were independent risk factor for ESBL-E transmission.

This study suggests that ESBL-E can be transmitted from mother to neonate. Maternal ESBL-E carriage and living with grandparents were associated with an increased risk of ESBL-E transmission. The ESBL-E carriage rate of pregnant women has increased worldwide and is different depending on countries from 4% in Europe to 15% in Africa. Other studies also have reported about the mother to neonate transmission rate in 20 to 40%.[1-3] Furthermore, nosocomial transmission in neonatal care room is also important ESBL-E transmission route.[3] Domestic or nosocomial transmission is another potential transmission route of ESBL-E.

(References)

1. Rettedal S, Löhr IH, Bernhoff E, Natås OB, et al. Extended-spectrum β-lactamase-producing Enterobacteriaceae among pregnant women in Norway: prevalence and maternal-neonatal transmission. J Perinatol. 2015;35:907-12.
2. Foessleitner P, Gasser J, Kiss H, Flunt A, et al. Vaginal colonization of extended-spectrum beta-lactamase-producing bacteria during pregnancy: An observational study. Eur J Obstet Gynecol Reprod Biol. 2020;246:86-89.
3. Neemann K, Olateju EK, Izevbigie N, et al. Neonatal outcomes associated with maternal recto-vaginal colonization with extended-spectrum β-lactamase producing Enterobacteriaceae in Nigeria: a prospective, cross-sectional study. Clin Microbiol Infect. 2020;26:463-469.

５．主な発表論文等

〔雑誌論文〕　計0件

〔学会発表〕　計1件（うち招待講演　0件／うち国際学会　1件）

１．発表者名 Tomohiro Hirade
２．発表標題 Transmission of extended-spectrum beta-lactamase-producing Escherichia coli to neonates: A cross-sectional study
３．学会等名 41st Annual Meeting of the European Society for Paediatric Infectious Diseases（国際学会）
４．発表年 2023年

〔図書〕　計0件

〔産業財産権〕

〔その他〕

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６．研究組織

	氏名 （ローマ字氏名） （研究者番号）	所属研究機関・部局・職 （機関番号）	備考

７．科研費を使用して開催した国際研究集会

〔国際研究集会〕　計0件

８．本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関