Antiseptics for Preventing Omphalitis

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Abstract

Background : Omphalitis may cause serious complications and contribute to neonatal morbidity and mortality. From January 1997 to August 1998, the incidence of omphalitis in the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital had been increased from 0.9 to 17.4 per 1000 live births. A prospective randomized trial using antiseptic applied directly to the umbilical stump was conducted aiming to reduce an epidemic outbreak of omphalitis in the newborn nursery.

Objective : To determine which antiseptic is appropriate for preventing omphalitis in the newborn infants.

Patients and Method : Newborn infants delivered in the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital were randomized into group A (Triple dye) or group B (70% Alcohol). The infant with omphalitis was assessed by a pediatrician or a neonatology fellow. At home, the same antiseptic will be continually applied to the umbilical stump daily until a few days after cord detachment. Relative risk was calculated and statistical significance was tested by Chi-square test.

Results : Four hundred and twenty-seven infants were enrolled. Birth weight, gestational age and gender of the infants in both groups were not different. There were no known maternal risk factors for omphalitis. Omphalitis was observed in 9/213 (4.2%) infants in group A and 23/214 (10.7%) infants in group B. The relative incidence rate between each group was statistically significant ($p<0.01$). Triple dye group was 60 per cent less likely to develop omphalitis compared to 70 per cent Alcohol group (RR 0.39, 95% CI: 0.19-0.83). The mean duration for cord detachment were 13.6 and 11.5 days in group A and group B, respectively.

Conclusion : During an epidemic outbreak of omphalitis, Triple dye was the most appropriate and effective antiseptic to prevent omphalitis but could delay cord separation.

Key word : Omphalitis, Antiseptic Prophylaxis, Umbilical Cord

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When the umbilical cord is cut and deprived of blood supply, the stump becomes dry gangrene. Blood vessels are still patent for a few days after birth, thus, they can be an entrance for systemic infection. Umbilical cord detachment is mediated by inflammation and normally occurs between 5 and 15 days after birth. After the umbilical cord separates, complete healing usually occurs in a few days. Within a few days after birth, skin of a newborn infant will be colonized with gram positive and gram negative bacteria from the environment[1-5]. Bacterial colonization can cause omphalitis which is an infection of the umbilicus and/or surrounding tissue and contributes to neonatal morbidity and mortality[6]. Infection of the umbilicus may cause serious complications, including abdominal wall abscess, necrotizing fasciitis, peritonitis, portal vein thrombosis, and septic emboli[7-9]. Aseptic cord care at birth and cord care with local antiseptics during the postnatal period until the umbilical cord is detached, are recommended by the World Health Organization to reduce the colonization rate of pathogenic bacteria[7]. From January 1997 to August 1998, the incidence of omphalitis in the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital increased from 0.9 to 17.4 per 1000 live births. A prospective randomized trial using antiseptics applied directly to the umbilical stump at birth was conducted aiming to reduce an epidemic outbreak of omphalitis in the newborn nursery.

Purpose of the Study

To determine which antiseptic is appropriate for preventing omphalitis in newborn infants.

PATIENTS AND METHOD

Newborn infants delivered in the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital were eligible for the study. Exclusion criteria included 1) infants with multiple congenital anomalies 2) infants for whom full support was not considered 3) no maternal consent. Maternal history, perinatal complications, birth weight, gestational age, and gender of the infants were recorded. Informed consent was obtained before randomization. Simple randomization was used. During the first phase of the trial, between November 23 and December 3, 1998, infants were randomized into group A (Povidone-iodine), group B (Triple dye) or group C (70% Alcohol). During the second phase, between December 4 and 29, 1998, infants were randomized into group A (Triple dye) or group B (70% Alcohol). Routine umbilical cord care was done twice a day by nursing staff. The nurses were informed to apply antiseptic to cover all areas of the umbilical stump but avoiding the skin. Stained skin may be misinterpreted as omphalitis or may conceal the diagnosis of omphalitis. Signs and symptoms of infection around the umbilical stump were closely monitored. When any sign of inflammation was detected, the umbilicus would be exposed to air with

the infant in the supine position. If the sign of inflammation disappeared within 1-2 hours, it would be considered an irritation. In order to decrease interpersonal variation of diagnosis of omphalitis the authors developed grading criteria based on their own experiences as shown in Table 1. Grade I: periumbilical cellulitis means erythema of the skin around the umbilical stump. Extension of the erythema was measured from the umbilical stump to the furthest point of redness. The infant with omphalitis was assessed and the severity was graded from I to IV by a pediatrician or a neonatologist who were familiar with these criteria. The treatment protocol was strictly applied for each severity (Table 1). Before discharge of an infant from the hospital, the mother was educated of how to clean the umbilical cord and observe signs of omphalitis at home. A letter was given to the mother at the time of discharge in order to obtain date of cord detachment. At home, the same antiseptic was continually applied to the umbilical stump daily until a few days after cord detachment.

Sample size calculation and statistical analysis

For the second phase of the clinical trial, to obtain 50 per cent reduction in the incidence of omphalitis with 0.05 significance level and power of 80 per cent, 398 infants were needed. Primary outcome of interest was the incidence of omphalitis in each treatment group. Relative risk was calculated and statistical significance was tested by Chi-square test.

RESULTS

During the first phase of the clinical trial, 93, 90, and 89 infants were enrolled to group A, B, or C respectively. Omphalitis was observed in 47 (50.5%) infants of group A, 7 (7.8%) infants of group B and 38 (42.7%) infants of group C (Table 2). The incidence of omphalitis was significantly different ($p < 0.001$). Since the incidence of omphalitis in the Povidone-iodine group was significantly higher than the other groups, the trial was terminated for ethical reasons. The isolated organisms were predominantly gram negative bacilli but a significant number of *Staphylococcus aureus* were also found. The data from phase I will not be discussed in this article due to incomplete data.

During the second phase of the clinical trial, four hundred and twenty-seven infants were randomized into group A (Triple dye, n=213) or group B (70% Alcohol, n=214). There were no known maternal risk factors for omphalitis. Birth weight, gestational age and gender of the infants in both

Table 1. Grading and treatment protocol for omphalitis.

Grading	Treatment
Grade I : Periumbilical cellulitis	
IA : Extent < 0.5 cm	Local antiseptic q 6 h
IB : Extent 0.5 -1.0 cm	Local antiseptic q 6 h and close observation in the nursery
IC : Extent > 1.0 cm	Systemic antibiotics*
Grade II : Omphalitis with discharge ± hemorrhage	Systemic antibiotics*
Grade III : Abscess formation	Systemic antibiotics* and surgical consultation
Grade IV : Omphalitis with clinical sepsis	Systemic antibiotics* and supportive treatment as sepsis

* Cloxacillin and gentamicin were used as empirical antibiotics

Table 2. Result of the study in phase I.

	Omphalitis				Total
	Yes	%	No	%	
Povidone-iodine	47	50.5	46	49.5	93
Triple dye	7	7.8	83	92.2	90
70% Alcohol	38	42.7	51	57.3	89

Chi-square $p < 0.001$

groups were not different (Table 3). Omphalitis was observed in 9 (4.2%) infants of group A and 23 (10.7%) infants of group B (Table 4). The relative incidence rate between each group was statistically significant ($p<0.01$). The triple dye group was 60 per cent less likely to develop omphalitis compared to 70 per cent of the Alcohol group (RR 0.39, 95% CI: 0.19-0.83)

The isolated organisms from omphalitis cases were gram negative bacilli (25 specimens) and gram positive cocci (3 specimens). These organisms were similar to the organisms isolated from the controlled infants (Table 5). The onset of omphalitis in group A was from 1-3 days (mean 1.89), and in group B it was 1-4 days (mean 2.45). The outcome of the omphalitis was satisfactory, none of the infants developed complications. The mean duration for cord detachment was 13.6 and 11.5 days in group A and group B respectively. After discharge, none of these infants was re-admitted to the hospital.

DISCUSSION

Between November 23 and December 29, 1998, there were 901 infants eligible for the study. A total of 699 (78%) infants were enrolled into both phases of the clinical trials. The only reason for not being enrolled was no maternal consent. The infants' gestational age, birth weight and gender in both groups were not different (Table 3).

The incidence of omphalitis in 70 per cent of the Alcohol group was significantly higher than the Triple dye group ($p<0.01$). It was found that *Enterobacter cloacae*, non-fermentative gram negative rod and *Klebseilla pneumoniae* were common pathogens isolated from the infants with omphalitis, while the other study found gram positive cocci to be

Table 3. Demographic data of the study population.

	Triple dye (n=213)	70% Alcohol (n=214)	P-value
Mean birth weight, g (range)	3,052 (1,670-4,300)	3,011 (1,120-4,500)	0.33
Mean gestational age, wk (range)	38.9 (32-43)	38.8 (30-44)	0.637
Male : Female	107 : 106	105 : 109	0.809

Table 4. Result of the study in phase II.

	Omphalitis (cases)				Total
	Yes	%	No	%	
Triple dye	9	4.2	204	95.8	213
70% Alcohol	23	10.7	191	89.3	214
Total	32	7.5	395	92.5	427

$p < 0.01$

Table 5. Organisms isolated from the infants.

Organisms	Omphalitis	Control
Enterobacter cloacae	10	4
Non-fermentative gram negative rod	8	4
Klebseilla pneumoniae	5	4
Coagulase negative staphylococcus	2	0
Miscellaneous	3	-

a more common pathogen[8]. However, both gram positive and gram negative bacteria were found to be more common causes of omphalitis among term infants, while gram negative bacteria was more common in premature infants in one study[10].

In the present study, gram negative bacilli found in infants with omphalitis were also found to be the most common pathogens colonized in the umbilical stump in the control group. However, infants with omphalitis had a greater colony count. Our result is different from Speck et al who found that staphylococci and streptococci were common organisms that colonized in the umbilical stump[1]. The difference in microorganisms depends on the bacteriologic epidemiology in each institution. The other possible explanation is Triple dye and 70 per cent Alcohol effectively reduce umbilical colonization with Staphylococci. Triple dye has been reported to be a good antiseptic to prevent Staphylococci colonization but not gram negative bacilli colonization[1,2]. In addition, repeated application of Triple dye is more effective than a single application at birth[2].

It is known that infection around the umbilical stump of an infant may cause serious complications. There have been reports of necrotizing fasciitis which progressed to death despite surgical debridement[8]. In the present study, most of the infected infants were classified as grade IA or IB and all of them were treated successfully with either Triple dye or 70 per cent Alcohol. Routine use of 70 per cent alcohol twice a day may not be effective to prevent omphalitis, however, with more frequent applications, 70 per cent alcohol could be used to treat a mild degree of omphalitis. Early detection and prompt treatment are essential for good outcome. Triple dye may be an effective antiseptic for preventing infection of the umbilical cord but it was found that timing of cord separation in infants treated with Triple dye was longer than the corresponding time in those treated with 70 per cent Alcohol (13.6 *vs* 11.5 days).

SUMMARY

In conclusion, the incidence of omphalitis in the infants treated with Triple dye was significantly lower than that of infants treated with 70 per cent Alcohol. Most of the infants with omphalitis were initially colonized with gram negative bacteria. During an epidemic outbreak of omphalitis, Triple dye was the most appropriate and effective antiseptic to prevent omphalitis but could delay cord separation. Early detection and prompt treatment with an appropriate antiseptic are essential for preventing complications of omphalitis. In addition, frequent application of an appropriate antiseptic is highly recommended for treatment of omphalitis.

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การป้องกันภาวะสะดืออักเสบในทารกแรกเกิด

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ภาวะสะดืออักเสบ (Omphalitis) เป็นสาเหตุสำคัญของการเจ็บป่วยและการเสียชีวิตของทารกแรกเกิด ในระหว่างเดือนมกราคม 2540–สิงหาคม 2541 ภาวะสะดืออักเสบของทารกที่รับไว้รักษาในภาควิชากุมารเวชศาสตร์ โรงพยาบาลศิริราช ได้เพิ่มสูงขึ้นจาก 0.9 เป็น 17.4 ต่อทารกเกิดมีชีพ 1,000 ราย คณะผู้วิจัยจึงได้ทำ randomized controlled trial เพื่อหาวิธีป้องกันภาวะสะดืออักเสบที่เกิดขึ้นในหอผู้ป่วยทารกแรกเกิด

วัตถุประสงค์ : เพื่อศึกษาชนิดของน้ำยาฆ่าเชื้อ (local antiseptic) ที่เหมาะสมสำหรับการป้องกันภาวะสะดืออักเสบในทารกแรกเกิด

ผู้ป่วยและวิธีการ : ทารกที่คลอดในภาควิชาสูติศาสตร์–นรีเวชวิทยา โรงพยาบาลศิริราชจะได้รับการแบ่งกลุ่มด้วยวิธีสุ่มตัวอย่าง โดยทารกกลุ่ม A จะได้รับการป้องกันภาวะสะดืออักเสบด้วย Triple dye และทารก กลุ่ม B จะได้รับการป้องกันด้วย 70% Alcohol โดยเริ่มตั้งแต่ระยะแรกเกิด จนถึงระยะ 1–2 วันหลังจากที่สะดือหลุด กุมารแพทย์จะเป็นผู้ให้การวินิจฉัยภาวะสะดืออักเสบตามหลักเกณฑ์ที่ได้กำหนดไว้ ข้อมูลที่รวบรวมได้จากการศึกษาจะนำไปหาค่าความเสี่ยงสัมพัทธ์ (Relative risk) และทดสอบทางสถิติโดยใช้ Chi-square test

ผลการศึกษา : การวิจัยครั้งนี้มีทารกเข้าร่วมทั้งหมด 427 ราย ทารกทั้ง 2 กลุ่มมีน้ำหนักแรกเกิด อายุครรภ์และเพศไม่แตกต่างกัน ไม่พบปัจจัยในมารดาที่ทำให้ทารกเสี่ยงต่อการเกิดภาวะสะดืออักเสบ คณะผู้ทำการวิจัยพบอุบัติการณ์ภาวะสะดืออักเสบ 9 ใน 213 ราย (4.2%) ในทารกกลุ่ม A และ 23 ใน 214 ราย (10.7%) ในกลุ่ม B อุบัติการณ์ในทารกทั้งสองกลุ่มมีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ($p < 0.01$) ค่าความเสี่ยงสัมพัทธ์เท่ากับ 0.39 และมีค่าช่วงความเชื่อมั่นร้อยละ 95 อยู่ระหว่าง 0.19 ถึง 0.83 ระยะเวลาเฉลี่ยที่สายสะดือหลุดคือ 13.6 วัน และ 11.5 วัน ในทารกกลุ่ม A และกลุ่ม B ตามลำดับ

สรุป : ในระยะที่มีการระบาดของภาวะสะดืออักเสบของทารกแรกเกิด Triple dye เป็นน้ำยาฆ่าเชื้อที่เหมาะสมสำหรับการป้องกันภาวะสะดืออักเสบ แต่อาจทำให้สายสะดือหลุดช้ากว่าการใช้ 70% Alcohol

คำสำคัญ : สะดืออักเสบ, การดูแลสายสะดือ

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