

소아비뇨기과 관혈적 수술 시 피부봉합제로 사용된 Octyl-2-Cyanoacrylate (Dermabond™)의 효용성

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Analysis of Octyl-2-Cyanoacrylate as a Dressing Material after Pediatric Urological Procedures

Purpose: We aimed to evaluate the efficacy of Octyl-2-cyanoacrylate (Dermabond™) as a topical skin adhesive for pediatric urologic open surgery.

Methods: From August 2010 to August 2011, we retrospectively evaluated pediatric patients who underwent urologic open surgery at our institution. A total of 128 pediatric patients with 210 incisions used Dermabond™ for skin closure.

Results: We divided the 128 patients into 3 groups according to type of surgery. Group 1 underwent hydrocelectomy (55 cases, 41.3%), Group 2 underwent orchiopexy (43 cases, 32.3%), Group 3 underwent penoplasty (35 cases, 26.4%). One hundred and twenty eight patients who underwent 133 surgeries in total, with a total of 210 incisions visited our outpatient department postoperatively, and a total of 5 wound complications (2.3%) occurred, but were simple inflammations and no dehiscence was observed. When analyzed according to groups, no wound problems occurred in Group 1 (0/55, 0%), one occurred in Group 2 (1/43, 2.3%) and four cases occurred in Group 3 (4/35, 11.4%) respectively. When re-analyzed according to wound locations, one occurred in an inguinal wound (1/120, 0.83%), none occurred in scrotal wounds (0/55, 0%), and four occurred in penile wounds (4/35, 11.4%). In Group 3, the incidence of penile wounds was significantly increased compared to other groups ($P=0.008$). All 5 wound problems were inflammatory and healed at an average of 13.8 days (13-15 days) with antibiotic ointment application only.

Conclusion: Dermabond™ is feasible and safe topical skin adhesive alternative to standard skin suture in pediatric urologic surgery. However, further research about its efficacy and safety could be valuable in the future.

Key words: Octyl-2-cyanoacrylate (Dermabond™), Urologic Surgical Procedures, Male, Tissue adhesives

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Introduction

Pediatric surgical wounds differ from those of adults in that management is extremely difficult. Children of young ages do not understand the importance of wound management, and self removal of dressing material is common. In urologic surgery, wounds of the scrotal, penile, and lower inguinal area are easily soiled by urine and feces in children. Numerous dressing methods presently used in wound management are based on the experience and bias of each individual surgeon; however, there are no generally accepted dressing methods applicable to all open surgical wounds in surgery. Tissue adhesives are gaining acceptance as an alternative form of wound closure in several areas of surgery [1]. In order to maintain the cleanliness of the wound, such dressing material such as Octyl-2-Cyanoacrylate (Dermabond™) has been introduced.

Dermabond™ has been introduced in 1949 in Germany. Multiple studies have shown that when properly used, the cosmetic outcome with adhesives are similar to sutures, with similar rates of wound infection and dehiscence [2]. Dermabond™ is a cyanoacrylate tissue adhesive that forms a layer above apposed wound edges, and permits normal healing beneath. It can be used to replace sutures that are 5-0 or smaller in diameter for incision wounds or laceration repair. Advantages of Dermabond™ are shorter time during wound repair, a flexible water-resistant protective coating, and no necessity of for suture removal [3]. The long-term cosmetic outcome with Dermabond™ is comparable to that of previously used repair methods. It is especially suited for small, superficial lacerations, and may also be used on larger wounds.

Bernard et al reported that Dermabond™ is an excellent tissue adhesive in children and adolescents [4]. However, research of Dermabond™ on pediatric urological wounds is rare. We aimed to evaluate the efficacy and safety of Dermabond™ as a sole dressing after pediatric urological surgery.

Materials and Methods

We retrospectively reviewed clinical data of patients who underwent pediatric urologic surgery at Seoul National University Children's Hospital Department of Urology from August 2010 to August 2011 by a single surgeon (KMK). 128 patients who underwent hydrocelectomies, orchiopexies and penoplasties were eligible for analysis. These 128 patients underwent a total of 133 surgeries, had a total of 210 incisions, and used Dermabond™ for skin closure. We divided the 128 patients into 3 groups according to type of surgery. Group 1 underwent hydrocelectomy (55 cases, 41.3%), Group 2 underwent orchiopexy (43 cases, 32.3%), and Group 3 underwent penoplasty (35 cases, 26.4%).

In the inguinal wounds, fascia closure was performed with 3-0 vicryl interrupted sutures, subcutaneous suture with 4-0 chromic interrupted sutures. Skin suture was performed with 4-0 rapid vicryl American suture. Penile and scrotal wounds were sutured with 6-0 vicryl. After suturing was completed, we applied Octyl-2-Cyanoacrylate (Dermabond™) in two layers. The first layer was applied with 4 mm space from the incision and dried at room temperature for 90 seconds. The second layer was applied with 4 mm space from the incision and dried for 5 minutes with a hair dryer held by the 2nd assistant 20 cm from the wound. In order to prevent Dermabond™ from sticking to the skin, we applied a thin layer of antibiotic ointment on scrotal and penile wounds and no additional dressing was done. We investigated wound complications 1 to 2 weeks postoperatively when the patients visited our outpatient clinic.

A descriptive analysis was performed with the independent t-test method. A 2-sided chi-square test analysis was performed using a commercial analysis program (SPSS ver. 18.0 (IBM, New York, NY, USA)). A lower than 0.05 p-value was considered to be statistically significant.

Results

The demographic characteristics were as follows

(Table 1). The average age of the patients was 3.85 (\pm 0.96, SD) years. Among the 210 incisions, 120 (57.1%) were inguinal, 58 (26.1%) were scrotal, and 35 (16.6%) were penile.

128 patients visited our outpatient clinic 1-2 weeks postoperatively. 5 wound complications occurred (2.3%) and all complications were inflammatory. According to groups, no wound problems occurred in Group 1 (0/55, 0%), one occurred in Group 2 (1/43, 2.3%) and four cases occurred in Group 3 (4/35, 11.4%) respectively. When re-analyzed according to wound locations, one occurred in an inguinal wound (1/120, 0.83%), none occurred in scrotal wounds (0/55, 0%), and four occurred in penile wounds (4/35, 11.4%). In Group 3, the incidence of penile wounds was significantly increased ($P=0.008$). In Group 2, the mean age of patients with wound complications was 1 years old, and the average age of those with complications was 9.5 years in Group 3, respectively. The

average age of patients without wound complications was 2.34 years, but there was no statistical significance between age and incidence of wound complications ($P=0.639$, 0.122 respectively). All 5 wound problems were inflammatory and healed at an average of 13.8 days (13-15 days) with Terramycin antibiotic ointment application only and did not require wound revision. The incidence of wound complications in group 3 were statistically higher than those of other groups ($P=0.008$) (Table 2).

The average age of patients with wound complications in Group 2 and Group 3 were 1 and 9.5 respectively. The average age of patients without wound complications in Group 2 and Group 3 were 2.34 and 5.61 respectively. ($P=0.639$, 0.122) (Table 3) Finally, when the incidence of wound problems and date of operation were analyzed, operations performed in January and February showed an incidence of wound problems which was highest of all months (7.7%).

Table 1. Patient Demographics

	Group 1	Group 2	Group 3	Total
No. Operations (%)	55 (41.3)	43 (32.3)	35 (26.4)	133
No. wounds (%)	55 (26.1)	120 (57.1)	35 (16.6)	210

Abbreviation: No., Number

Table 2. Incidence of Wound Complications According to Incision

Group	Location of Incision	Number of Incisions	Number (%) of wound complications
1	Inguinal	55	0 (0)
2	Inguinal	65	1 (1.7)
	Scrotal	55	0 (0)
3	Penile	35	4 (11.4)
Total		210	5 (2.3)

$P=0.008$.

Table 3. Incidence of Wound Complication According to Age

	Average age in wound complications	Average age in no complications	P value
Group 1	-	3.68	-
Group 2	1	2.34	0.639
Group 3	9.50	5.61	0.122
Total	7.8	3.2	

Table 4. Incidence of Wound Complications According to Time Period

Period	August	September -October	November -December	January -February	March -April	May -June	July -August	Total
Surgeries	2 (1.5%)	20 (15.0%)	21 (15.8%)	20 (15.0%)	30 (22.5%)	20 (15.0%)	20 (15.0%)	133
Incisions	2	30	30	28	48	36	36	210
Wound complications	0 (0%)	1 (3.3%)	0 (0%)	2 (7.7%)	2 (4.3%)	0 (0%)	0 (0%)	5 (2.3%)

Discussion

Since 1949, skin adhesives have been applied for medical use. Cyanoacrylate, the first adhesive used for skin closure, polymerizes in contact with human tissues. The last generation of these adhesives is octylcyanoacrylate (Dermabond™; Ethicon, Summerville, NJ, USA), which results in less heat when applied, lower inflammatory reaction, and relatively higher tensile strength than the previous compounds [5]. Since receiving Food and Drug Administration (FDA) approval, in multiple studies Dermabond™ has achieved cosmetic and functional outcomes similar and even superior to those of conventional skin sutures for closing simple, tension-free wounds. However, foreign body reaction to this skin adhesive has also been reported in this setting [6]. Yamamoto et al. speculated that "tissue adhesive within

the wound may result in a foreign body reaction and form a nidus for infection”, which could be a potential disadvantage of Dermabond™ [7]. In 1959, Coover et al reported the first case of successful wound closure with cyanoacrylate [2]. Similar results (using both the butyl- and octylcyanoacrylates) have been reported in a wide variety of clinical settings and specialties [8].

Since the introduction of cyanoacrylates, short-chained cyanoacrylates have been used for skin closure in surgery with good aesthetic results. However, due to reactions induced by the glues, new longer-chained octyl-2-cyanoacrylate (Dermabond™) improves the breaking strength compared to older adhesives [9]. Dermabond™ reacts chemically to the skin surface by polymerization induced by anions that are physiologic on the skin surface.

Shapiro et al compared the tensile strength of staples, sutures, glues, and steri-strips. Closure with Dermabond™ was faster and less painful than sutures, and cosmetic results and patient satisfaction were improved [10]. Dermabond™ is especially useful in children because removal is unnecessary, and it provides a water-proof barrier which makes additional dressing unnecessary [11]. Another advantage is that Dermabond™ has a significant antimicrobial effect against Gram-positive organisms [12]. In addition, apply of Dermabond™ is almost painless, which suggests its potential use for wound closure under local anesthesia, although was irrelevant in our study, as all of the patients were under general anesthesia. Yet, a higher cost may be a disadvantage, however, in a study performed by Singer et al [13] and Osmond et al [14], Dermabond™ was actually less expensive if used on more than 10 patients. Such a study on Korean patients has not been performed, but might be beneficial in the future. It is important to emphasize that the use of tissue adhesives is a manual skill that requires appropriate selection of tissue adhesive. New tissue adhesive applicators could be useful in the future for pediatric wounds. [15]

Our study has the advantage that it is a unique study in the Korean population. Although studies about Dermabond™ have been performed in several other countries, none have been performed in Korea. Lee et

al mentioned repairing a laparoendoscopic single-site surgery wound with Dermabond™ [16], but other than that there are no studies performed in Korea. Ferlise et al reported the safety of under a diaper [11]. As many of pediatric urologic surgeries are often performed on children wearing diapers, a tissue adhesive that can be safely applied under a diaper is beneficial.

However, this study has many limitations. It is a retrospective study, and we only analyzed the benefits of Dermabond™, therefore its surgical advantages with sutures, staples, or steri-strip were not comparable. Yet, as previously mentioned, the advantages of Dermabond™ have been investigated in other studies, therefore, the fact that Dermabond™ was tolerable and with few complications in the Korean pediatric population is valuable in choosing adhesive material in Korean institutes.

Why seasonal differences in incidence of wound complications occurred is not definite. As the winter vacation period in Korea is from January to February, we initially speculated that the high number of surgeries performed during the vacation might be related to such a higher incidence of complications. However, no correlation seemed to be discovered. Therefore, in future studies, a more detailed analysis of factors correlated with wound complications could be recommendable. We estimated that the higher incidence of penile wounds is related with contact to urine and feces, and spontaneous erection. The incidence or correlation was not examined in this paper, which is a limitation. Ferlise et al reported that when using Dermabond™ under a diaper, making sure that the tissue adhesive is completely dry before moving the child or putting the diaper on is the most important factor [11]. Therefore, such precautions can be recommendable. However, the purpose of this study was not to investigate the advantages of Dermabond™ itself, but to examine its efficacy and safety in the Korean pediatric population. Based upon our results, Dermabond™ is a feasible and applicable wound dressing method.

Dermabond™ is a feasible and safe topical skin adhesive alternative to standard skin suture in pediatric urologic surgery. However, further research about its efficacy and safety could be valuable in the future.

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한글요약

목적: 소아비뇨기과 관혈적 수술 시 피부봉합제로 사용된 Octyl-2-Cyanoacrylate (Dermabond™)의 효용성에 대해 알아보려고 하였다.

방법: 2010년 8월부터 2011년 8월까지 1년 동안 서울대학교 어린이병원 소아비뇨기과에서 단일 술자에 의해 음낭수종절제술, 고환고정술, 음경성형술을 시행받은 환자들을 대상으로 상처 합병증 발생율을 후향적으로 비교분석하였다. 총 128명을 대상으로 210개의 절개창에서 시행되었으며, 피부 봉합에 Dermabond™을 사용하였다. 모든 절개창은 Dermabond™을 사용하기 전 흡수사를 이용하여 표피 밑 봉합 혹은 몇 개의 단순 봉합을 시행하였다. Dermabond™는 4 mm 너비로 얇게 두 번 사용되었으며, 건조시키는 과정이 포함되었다. 추가적인 붓대나 드레싱은 적용되지 않았다.

결과: 128명의 환자들을 수술 종류에 따라 세 그룹으로 나누었다(Group 1: 음낭수종 절제술, 55례, 41.3%; Group 2: 고환고정술, 43례, 32.3%; Group 3: 음경성형술, 35례, 26.4%). 수술 후 외래에서 추적 관찰한 210개의 절개창에서 총 5개(2.3%)에서 상처 합병증이 발생하였고, 이를 그룹별로 다시 분석해 보면 Group 1에서 0개(0/55, 0%), Group 2에서 1개(1/43, 2.3%), Group 3에서 4개(4/35, 11.4%)가 각각 발생하였다. 상처 부위별로 다시 분석해 보면 서혜부 상처 1개(1/120, 0.83%), 고환 상처 0개(0/55, 0%), 음경 상처 4개(4/35, 11.4%)가 각각 발생하였다. Group 3의 음경 상처에서 다른 군에 비해 통계적으로 의미 있게 증가되었다($P=0.008$). Group 2와 3에서 상처 합병증이 발생한 환자들의 평균 나이는 각각 1세, 9.50세 이었고 상처 합병증이 없는 환자들의 평균 나이는 2.34세, 5.61세 였지만 통계적으로 의미는 없었다($P=0.639, 0.122$). 5개의 상처 합병증은 모두 가벼운 염증반응이었으며, 항생제 연고만을 적용 후 수술 후 평균 13.8일(13-15일) 후 모두 치료되었다.

결론: Dermabond™는 소아비뇨기과에서 음낭수종절제술과 고환고정술 시 피부봉합제로서 기존의 피부 봉합에 대한 대안으로 안전한 방법으로 사료된다. 하지만 음경성형술에서는 향후 더 많은 연구가 필요하다.

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