Çoc. Cer. Derg. 2021;35(3):143-7
doi:10.5222/JTAPS.2021.50469

Özgün Araştırma / *Research Article*

Graft Infections After Abdominal Closure With Polytetrafleuroethylene Graft in Neonates

Yenidoğanlarda Politetrafloroetilen Greft ile Karın Duvarı Kapatılması Sonrası Greft Enfeksiyonları

Bilge Gördü, Tutku Soyer, Ozlem Boybeyi Turer, Feridun Tanyel

Hacettepe Üniversitesi Tıp Fakültesi, Çocuk Cerrahisi Ana Bilim Dalı, Ankara, Türkiye

ABSTRACT

Objective: *A retrospective study is performed to evaluate the clinical features and treatment of graft infections (GI) after abdominal wall closure with polytetrafleuroethylene (PTFE) grafts in neonates.*
Methods: *Neonates with graft repair were evaluated for age, sex, birth weight, gestational week and development of GI retrospectively.*
Results: *Among 13 neonates, five (38.5%) of them developed clinical findings of GI. The indications of graft repair were congenital diaphragmatic hernia (n=10, 76.9%), omphalocele (n=1, 7.6%) and gastroschisis (n=2, 15.3%). The mean gestational age and birth weights of all cases were 37.4 weeks, 2985 g (1750-3850 g) and 38 weeks, 2920 g (1750-3600 g) in neonates with GI. Staphylococcus aureus (n=4) was the most common isolated microorganism in wound cultures. The graft was removed in one of the neonates with positive blood steam cultures and clinical findings of sepsis.*
Conclusion: *GI may occur in approximately one third of the abdominal wall repairs with PTFE in neonates.*

Keywords: *Graft, infection, abdominal wall defects, neonate*

ÖZ

Amaç: *Yenidoğanlarda politetrafloroetilen (PTFE) greftlerle karın duvarı kapatılması sonrası greft enfeksiyonlarının (GI) klinik özelliklerini ve tedavisini değerlendirmek için retrospektif bir çalışma yapılmıştır.*
Yöntem: *Greft onarımı yapılan yenidoğanlar yaş, cinsiyet, doğum ağırlığı, gebelik haftası ve greft enfeksiyonu gelişimi açısından retrospektif olarak değerlendirildi.*
Bulgular: *13 yenidoğandan beşinde (%38,5) GI klinik bulguları gelişti. Greft onarımı yapılan hastalar 10'u konjenital diyafragma hernisi (%76,9), biri omfalosel (%7,6) ve ikisi gastroşizis (%15,3) idi. Tüm olguların ortalama gebelik yaşı ve doğum ağırlıkları 37.4 hafta, 2985 g (1750-3850 g) ve GI enfeksiyonu olan yenidoğanların ortalama gebelik yaşı ve doğum ağırlıkları 38 hafta, 2920 g (1750-3600 g) idi. Yara kültürlerinde en sık Staphylococcus aureus (n = 4) izole edildi. Bir yenidoğanda sepsis kliniği ve pozitif kan kültürü olması nedenli greft çıkarıldı.*
Sonuç: *Yenidoğanlarda PTFE ile yapılan karın ön duvarı onarımlarının yaklaşık 1/3'ünde GI meydana gelebilir.*

Anahtar kelimeler: *Greft, enfeksiyon, karın duvarı defektleri, yenidoğan*

Received/Geliş: 08.03.2021
Accepted/Kabul: 10.06.2021
Published date:

Cite as: Gördü B, Soyer T, Boybeyi Türer Ö, Tanyel F. Graft Infections After Abdominal Closure With Polytetrafleuroethylene Graft in Neonates. Çoc. Cer. Derg. 2021;35(3):143-7.

Bilge Gördü
Hacettepe Üniversitesi Tıp Fakültesi,
Çocuk Cerrahisi Anabilim Dalı,
Ankara - Türkiye
bilgegordu@gmail.com
ORCID: 0000-0002-7095-7225

T. Soyer 0000-0003-1505-6042
Ö. Boybeyi Türer 0000-0002-0465-7793
F. Tanyel 0000-0002-8301-3012

Introduction

Synthetic or biological materials have been used as prosthetic patches for abdominal wall closure in congenital abdominal wall defects [1]. Polytetrafleuroethylene (PTFE, Goretex) have been used for defect closure as a temporary measure until the fascia opposition is obtained at late term of repair. They usually incorporated to abdominal wall and support epithelialization [2]. These materials are not as good as biological materials to improve tissues ingrowth and granulation when they are used as permanent. The graft repair of abdominal wall is also used to avoid abrupt increase in intra-abdominal pressure in the congenital diaphragmatic hernia (CDH) [3,4]. Although abdominal wall repair with PTFE offer staged abdominal wall closure in giant omphaloceles, it is associated with high risk of infection, wound dehiscence, loss of fascial margin integrity, delayed introduction of enteral feeding and fistula formation [3]. The risk of infection is significantly increased after postoperative one week and cause delay in granulation and epithelialization. Rarely, graft infection (GI) cause bacteremia, sepsis and require prompt removal of the synthetic material. The incidence of GI and its microbiological properties are not well defined in systematic reviews and no randomized controlled trails have been reported. Therefore, a retrospective study is performed to evaluate the clinical features and treatment of GI after abdominal wall repair with PFTE graft in neonates.

Material and Method

Patients, who underwent graft repair for abdominal closure between 2013-2020 were evaluated respecting age, sex, birth weight, gestational week and time of graft application retrospectively. Patients with congenital abdominal wall defects (omhalocele and gastroschisis) and CDH who require delayed abdominal closure because of increased intra-abdominal pressure were included. A polytetrafleuroethylene graft [PTFE, Goretex (W. L. Gore & Associates, Inc., Elkton, Maryland, United States)] was used to close abdomen. PTFE grafts were sutured to fascia with non-absorbable 3/0 sutures and none of the patients required skin closure over grafts to avoid increase in intra-abdominal pressures. Daily dressings with with Xeroform® were performed until graft removal. The grafts were applied as temporary fashion and removed for permanent fascia closure after complete reduction of intra-abdominal organs. Patients with purulent discharge form graft, elevated white cell counts, fewer and isolated positive microorganisms from graft swabs were considered as GI. Otherwise, patients with no symptoms were considered as colonization and did not require any antimicrobial treatment. In our study group all patients with positive swab cultures were symptomatic and they are considered as GI after pediatric infection consultation. All patients received preoperative ampicillin (75/mg/kg/24hr) and gentamicin (4/mg/kg/24hr) medication. According to infection findings and swab cultures, antimicrobial treatment was changed. Patient with GI were also investigated for clinical findings, isolated microorganisms and treatment alternatives. The Local Ethical Committee (GO-118/2018) approved the study.

Results

In this period of 7 years, the retrospective data of 13 cases were included. Male female ratio was 9:4. Ten (76.9%) of cases were CDH, 1 of them (7.6%) was omphalocele and 2 of them were (15,3%) gastroschisis. In the mentioned time period 48 patients with CDH, 5 patients with omphlocele and 12 patients with gastrochisis were operated. Among 13 of cases, 5 (38.4%) of them developed clinical findings of GI such as. Patients who developed GI were CDH (n=4), omphalocele (n=1). The mean gestational age of non-infected cases was 37 weeks and 38 weeks in patients with GI. Mean birth weight was 3026 g (2470-3850 g) in non-infected cases and 2920 g (1750-3600 g) in patients with GI. The mean graft repair time was 2th day of postnatal life in non-infected cases and 3.2th day in GI cases. There was no graft dehiscence. Patients with wound hyperemia, purulent discharge and fever were considered as GI and confirmed by consultation to pediatric infections disease department. Postoperatively antimicrobial treatment was revised to vankomycin (80/mg/kg/24hr), meropenem(60/mg/kg/24hr), amikacin (15/mg/kg/24hr) and fluconazole (6/mg/kg/24hr) in patients with GI. Postoperative GI was seen on the 16th day at earlier and on the 90th day at the latest.

Patients with GI had purulent drainage at wound

sides (Figure 1). One of the cases was present with clinical and laboratory findings of sepsis. Five of the cases had positive wound cultures and two of them had concomitant blood stream infections. The microorganism isolated form wound and blood stream cultures are listed in Table 1. Although, isolated microorganism are found in the normal skin flora in some patients, all neonates received antibiotics. In one of the cases, graft was removed to control the GI (Figure 2). This patient was followed up with wound dressing without applying a new graft until the infection control has been achieved. Then fascia closure was done. In one of the patients, despite the clinical findings of infection, no microorganism was isolated in wound cultures. The graft application was used as a temporary application. The grafts removed later in all patients.

Figure 1. Graft infection after repair of abdominal wall defect.

Table 1. Isolated microorganisms in patients with GI.

Wound cultures (n)	Blood stream cultures (n)
Staphylococcus aureus (n=4)	*Staphylococcus epidermidis* (n=1)
Staphylococcus epidermidis (n=1)	*Bacillus licheniformis* (n=1)

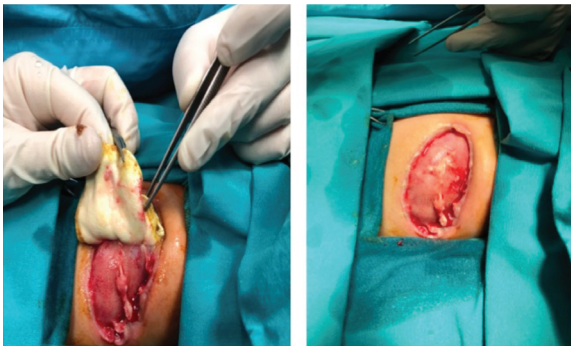

Figure 2. Removal of graft to control GI in a patient with omphalocele.

Discussion

Gastroschisis and omphalocele present unique challenges to the pediatric surgeon. In recent years, the main purpose in the treatment of gastroschisis and omphalocele is to close the fascia and skin without increased intra-abdominal pressure and tension of the abdominal wall [4]. The prosthetic mesh repair of abdominal wall defects are commonly used for staged repair of congenital defects. In addition to congenital abdominal wall defects, PTFE repair can be used to decrease intra-abdominal pressure after CDH [4]. It has been reported that 40% of patients with CDH may require delayed abdominal closure and the mortality of cases with primary and delayed repair is similar [4]. Infection complication is major concern for the patients with PTFE grafts and can be seen despite aseptic technique and prophylactic antibiotics. The exact incidence of GI after PTFE repair is poorly understood because of lack of standardized definition of GI [5]. However, the infection rates are as high as 10% with PFTE grafts after hernia repair and 1-4% for abdominal wall hernia repair in adult series [6,7]. Studies investigated the incidence and risk factors for GI have been focused on data observed form adults cases and there is no clear information about GI rates in neonates and children.

In our study, approximately one third of our cases developed clinical and laboratory findings of GI after abdominal wall repair. The higher rate of GI in our study cohort can be explained by the definition of GI in neonates. We considered patients with both clinical findings and isolated microorganisms from wound swabs as GI. Although, some of the isolated microorganisms are found in normal skin flora, it was no possible to consider this finding as contamination in neonates with symptoms. In our study, the patients with symptoms such as purulent discharge; elevated white cell counts and fewer were considered as GI. Otherwise, patients with no symptoms should be considered as colonization and did not require any antimicrobial treatment. In our study group all pati-

ents with positive swab cultures were symptomatic and they are considered as GI after pediatric infection consultation. Therefore, true incidence of GI is still unclear and requires prospective studies with larger cohort of patients.

The patient factors associated with GI infection are high body mass index, smoking, advanced age and underlying chronic respiratory disease [8]. However, these are not considered as risk factors in infants and children. When we evaluate the patient factors such as gestational age, birth weight and time of graft repair, the results of patients with GI is similar to patients with no signs of infections. Although, wound infections were reported to be more common in neonates with gastroschisis, none of the studies defined the type of congenital anomaly and the indication of graft repair as patient-related risk factor for the development of infections complications after greft repair [9].

The clinical findings of mesh infections include fever, pain, local swelling and discharge from wound. Laboratory findings such as increased leucocyte counts; elevated sedimentation rates and C-reactive protein levels are consistent with GI. Clinical signs of sepsis can be seen in patients with severe GI. Close follow-up and frequent dressing is recommended for detection of infection complications after graft repairs. The natures of grafts are also important factor for developing infections. Colonization and adherence of bacteria on the surfaces of mesh is prerequisite for graft related infections. The pore size and adhesive properties of grafts are also important for infectious complications. There is no information existing about the difference between PTFE and other synthetic grafts for developing graft infection in pediatric population. It has been suggested that covering the defect with skin cover is very important to prevent GI. However, skin covering may increase intra-abdominal pressure and should avoided in patients with increased risk of abdominal compartman syndrome. In addition to place a graft, the formation of rotation flaps and the closure of the defect is considered to be a factor to avoid GI [10].

The most common isolated organisms form graft swabs are *Staphylococcus* spp especially *S. aureus*, *Streptococcus* spp and gram-negative bacteria (mainly enterebacteriaceae) and anaereobic bacteria (*Peptostreptococcus* spp) [11]. In our study, the isolated organisms were *Staphylococcus* spp. *S. aureus* is often present on skin and form biofilms, thus is the most common organism associated with GI. Similar to incidence, there is little known about the common organisms causing GI in neonates and infants. Our results suggest that isolated subspecies of organisms from infected wounds of grafts are similar in adults and children. The blood stream cultures are also needed in case of clinical suspicion of bacteremia and sepsis. Two of our patients had positive blood stream cultures but only one developed the clinical signs of sepsis. Despite clinical features, no microorganism can be isolated in patients with GI. Since, both wound and blood stream cultures may not be consistent with the clinical findings in children, we suggest that empirical antibiotic treatment covering most common isolated microorganism in GI can be used in most cases.

The infections complications of grafts are reoperation, prolonged hospital stay and increased costs [12]. The most common cause of reoperation is GI. There is lack of data about the optimum treatment of GI and no guideline has been reported. The medical management of GI is antimicrobial therapy and local wound dressing. The abscess drainage and debridement of necrotic tissues should be performed. The graft salvage cannot be possible in every case. Although, pediatric data does not exist about the partial removal of grafts, the adult series demonstrate worse outcomes with partial removal and graft salvage methods [13]. Also, salvage rates of PTFE grafts have less than propylene grafts (4.5% vs 19.6%) [14]. In another study that there was no difference between grafts in terms of infection, but this was due to numerous confounding factors and small sample size [8].

The graft removal should be considered when conservative methods are failed. In our series, we had to remove the graft in one case to control infection. The goal of surgical treatment of GI is remove all necrotic tissues, promote tissue granulation and reinforcement of abdominal wall. In contrast to adults, none of the infants required additional treatment for reinforcement after removal of grafts. The granulation tissue has been already formed at the time of infec-

tion (Figure 2). Wounds were left for primary healing in all cases. Therefore, biological grafts can be used for these newborns.

The limited number of patients and retrospective analysis of cases are major limitations of our study. There are no guidelines and randomized trails for GI after abdominal wall repair in neonates. However, the results of our study suggest that one third of the abdominal wall repairs with PTFE graft developed clinical findings of GI. Biological grafts can be preferred in these patients. Most of the isolated microorganisms are found as normal flora of skin and in some cases, signs of infection may occur although the microorganism cannot be isolated. In cases with sepsis and bacteremia, grafts should be removal for infection control.

Ethics Committee Approval:

Conflict of Interest: All authors declare no conflict of interest.

Funding: No financial and non-financial benefits have been received or will be received form any party related directly or indirectly to the subject of this article.

Informed Consent: Receipt.

References

1. Marven S, Owen A. Contemporary postnatal surgical management strategies for congenital abdominal wall defects. Semin Pediatr Surg. 2008;17(4):222-35. https://doi.org/10.1053/j.sempedsurg.2008.07.002
2. Hernández Siverio N, E ML-TF, Mario Troyano Luque J. Gastroschisis: primary closure using umbilical cord strengthened by a polypropylene mesh. J Perinat Med. 2007;35(3):249-51. https://doi.org/10.1515/JPM.2007.051
3. Bauman B, Stephens D, Gershone H, Bongiorno C, Osterholm E, Acton Rve ark. Management of giant omphaloceles: A systematic review of methods of staged surgical vs. nonoperative delayed closure. J Pediatr Surg. 2016;51(10):1725-30. https://doi.org/10.1016/j.jpedsurg.2016.07.006
4. Gamba P, Midrio P. Abdominal wall defects: prenatal diagnosis, newborn management, and long-term outcomes. Semin Pediatr Surg. 2014;23(5):283-90. https://doi.org/10.1053/j.sempedsurg.2014.09.009
5. Narkhede R, Shah NM, Dalal PR, Mangukia C, Dholaria S. Postoperative Mesh Infection-Still a Concern in Laparoscopic Era. Indian J Surg. 2015;77(4):322-6. https://doi.org/10.1007/s12262-015-1304-x
6. Paton BL, Novitsky YW, Zerey M, Sing RF, Kercher KW, Heniford BT. Management of infections of polytetrafluoroethylene-based mesh. Surg Infect (Larchmt). 2007;8(3):337-41. https://doi.org/10.1089/sur.2006.053
7. Guillaume O, Pérez-Tanoira R, Fortelny R, Redl H, Moriarty TF, Richards RGve ark. Infections associated with mesh repairs of abdominal wall hernias: Are antimicrobial biomaterials the longed-for solution? Biomaterials. 2018;167:15-31. https://doi.org/10.1016/j.biomaterials.2018.03.017
8. Mavros MN, Athanasiou S, Alexiou VG, Mitsikostas PK, Peppas G, Falagas ME. Risk factors for mesh-related infections after hernia repair surgery: a meta-analysis of cohort studies. World J Surg. 2011;35(11):2389-98. https://doi.org/10.1007/s00268-011-1266-5
9. Clements KE, Fisher M, Quaye K, O'Donnell R, Whyte C, Horgan MJ. Surgical site infections in the NICU. J Pediatr Surg. 2016;51(9):1405-8. https://doi.org/10.1016/j.jpedsurg.2016.04.002
10. Sezgin B, Tuncer S, Özen O, Şibar S. Yenidoğanda omfalosel defektinin kombine polipropilen ve okside rejenere selüloz içerikli yama ve rotasyon flepleriyle onarımı. Çocuk Cerrahisi Dergisi. 2015;29(1):40-3.
11. Taylor SG, O'Dwyer PJ. Chronic groin sepsis following tension-free inguinal hernioplasty. Br J Surg. 1999;86(4):562-5. https://doi.org/10.1046/j.1365-2168.1999.01072.x
12. Hawn MT, Gray SH, Snyder CW, Graham LA, Finan KR, Vick CC. Predictors of mesh explantation after incisional hernia repair. Am J Surg. 2011;202(1):28-33. https://doi.org/10.1016/j.amjsurg.2010.10.011
13. Bueno-Lledó J, Torregrosa-Gallud A, Carreño-Saénz O, García-Pastor P, Carbonell-Tatay F, Bonafé-Diana Sve ark. Partial versus complete removal of the infected mesh after abdominal wall hernia repair. Am J Surg. 2017;214(1):47-52. https://doi.org/10.1016/j.amjsurg.2016.10.022
14. Greenberg JJ. Can infected composite mesh be salvaged? Hernia. 2010;14(6):589-92. https://doi.org/10.1007/s10029-010-0694-8