



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Meckel's diverticulum perforation in a newborn positive to Sars-Cov-2

E. Bindi^a, A. Crucetti^a, M. Ilari^a, F. Mariscoli^a, V.P. Carnielli^{d, b}, A. Simonini^c, G. Cobellis^{a, b, *}

^a Pediatric Surgical Unit, Salesi Children's Hospital, Ancona, Italy

^b University Politecnica delle Marche, Ancona, Italy

^c Pediatric Intensive Care Unit, Salesi Children's Hospital, Ancona, Italy

^d Neonatology Unit, Salesi Children's Hospital, Ancona, Italy

ARTICLE INFO

Keywords:

Meckel's diverticulum
Neonatal
COVID-19

ABSTRACT

The health emergency linked to the Sars-Cov-2 infection represented an absolutely new problem for all health professionals. In particular, the information regarding the spread of the virus in the pediatric field and its manifestations are still incomplete. In this paper we present a case of neonatal infection which, as far as we know, represents one of the few published cases and which occurred in a patient who came to our attention for acute abdomen from intestinal perforation. The perforation was caused by Meckel's diverticulum, an event considered infrequent in the first year of life and almost exceptional in the neonatal period. This case required particular management, putting pediatric surgeons in front of new and difficult to solve problems. New onset clinical events, such as this one described, represent an opportunity for sharing useful data for the creation of universal protocols for the management of patients with problems that are becoming common and of which little is known.

1. Introduction

During the current emergency regarding the Sars-Cov-2 virus, the amount of information available to the scientific community is growing day by day. One of the data that seems to emerge is that the infection in the pediatric population is very often free of clinical symptoms or signs, and in symptomatic patients it presents with mild respiratory or gastrointestinal manifestations [1]. There are clinical cases from China that report patients of a few days of life with symptoms similar to sepsis or feeding intolerance [2,3].

As far as we know, in Literature there are no cases of pediatric patients with surgical pathology related to coronavirus disease 2019 (COVID-19), and let alone, there is still no data on a possible relationship between the infection and the onset of surgical complications.

In this work we present the case of a patient in neonatal age, that underwent surgery, for intestinal perforation on Meckel's diverticulum, in which was subsequently made diagnosis of Coronavirus infection.

2. Case report

A three-day-old male infant was transferred to the Salesi Children's Hospital in Ancona (Italy) for history of feeding intolerance, biliary gastric stagnation and abdominal distension. An x-ray examination of the abdomen was performed and showed a picture of pneumoperitoneum. The patient was admitted to the neonatal intensive care unit, and a second x-ray of the abdomen confirmed the presence of abdominal free air. Clinically the patient presented a picture similar to that of an early sepsis. An urgent intervention of abdominal exploration was performed. A right sovra-umbilical laparotomy was performed and the presence of abundant free stools was highlighted. During the exploration of the intestinal loops, the presence of a perforated Meckel diverticulum was found at about 15 cm from the ileocecal valve (Fig. 1). The rest of the intestine was in good condition, with no signs of inflammation. The portion of the ileal loop affected by the diverticulum was resected and an ileo-ileal end-to-end anastomosis was performed.

At the beginning, after surgery, the patient presented stable clinical conditions. In the fifth postoperative day, however, the patient presented an important abdominal wound dehiscence with leaking stool. For this reason, a second abdominal exploration was performed and a dehiscence of the intestinal anastomosis was highlighted, in the

* Corresponding author. Pediatric Surgical Unit, Salesi Children's Hospital, Italy.
E-mail address: giovanni.cobellis@ospedaleiriruniti.marche.it (G. Cobellis).



Fig. 1. Intraoperative finding of perforated Meckel's diverticulum.

absence of further anomalies. A second end-to-end ileoileal intestinal anastomosis was carried out. We decided to not perform an ileostomy diversion, since the fact that the ileal loops appeared in a good condition. After the second intervention, the patient presented a regular course. Unfortunately the pediatrician who transferred the patient from the peripheral hospital was symptomatic and resulted positive for Sars-Cov-2.

On the second post-operative day, a pharyngeal swab was also performed on our patient, resulting "positive". The patient was therefore isolated at the pediatric intensive care unit. The health staff, who came into contact with the patient, was subjected to pharyngeal swab, without detecting positive individuals. Also the mother was subjected to pharyngeal swab resulting negative for Sars-Cov-2. The patient was kept isolated at the Pediatric Intensive Care Unit for ten days after which it was transferred to the Neonatal Intensive Care Unit. The patient was discharged at two months of life and at 4 months follow-up is asymptomatic.

3. Discussion

Meckel's diverticulum originates from an incomplete obliteration of the omphalomesenteric or vitelline duct, which occurs around the fifth week of gestation. It usually appears as a pouch, located on the antimesenteric border of the ileum at a length between 40 and 60 cm from the ileocecal valve [4]. Meckel's diverticulum is one of the most common anomalies of the GI tract, present in 2–3% of individuals and it is often clinically silent and discovered incidentally during interventions performed for other reasons. When symptomatic, the most common presentation is represented by recurrent abdominal pain, gastrointestinal bleeding and bowel obstruction, due to intussusception and volvulus [5]. Perforation of the diverticulum, as an initial symptom, is reported with an incidence rate of 10% in the first year of life [6], but in the neonatal period is considered exceptional, being reported in only 11 patients during the last 30 years [7,8]. The recognized causes of perforation in the newborn are perinatal hypoxia/anoxia, maternal administration of corticosteroids and cocaine abuse, and exchange transfusion for hemolytic disease of the newborn.

A recent review [9] describes that pneumoperitoneum is present as the main feature in the 33% of the patients with complicated Meckel's diverticulum. In these cases an explorative laparotomy is mandatory, and the diagnosis comes easily. It can be safe to perform primary anastomosis after resection for perforated diverticulum in the neonatal population, even in those of low birth weight, avoiding in this way the morbidity of a second intervention for stoma closure. The reported rate about dehiscence after a primary anastomosis is around 5% [10], but it depends also about the conditions of the patient.

The coronavirus disease 2019 (COVID-19) has spread rapidly across the world. Unlike what was thought at the beginning, the infec-

tion did not remain limited to the older segment of the population, and with the sharp increase in the number of infections, the number of pregnant women and children with COVID-19 is also on the rise. Infection in children, however, remains a very limited phenomenon. A recent review of 72,314 cases by the Chinese Center for Disease Control and Prevention showed that less than 1% of the cases were in children younger than 10 years of age [11]. In contrast with infected adults, most infected children appear to have a milder clinical course and asymptomatic infections are not uncommon. Infact, compared with the clinical characteristics of adult cases, the obvious phase of symptoms lasts for 1–2 weeks after the disease, and the detoxification period can lasts for 3–4 weeks or longer. The condition of children is milder, recovery faster, and have a better prognosis. Only few cases may progress to lower respiratory tract infection [12]. Due to the low number of cases in children, compared to adults, we have little data available to evaluate the real impact of the infection in this group of patients. In this sense, we know even less about neonatal infection. A number of case reports have been published looking at the outcomes of pregnant mothers with COVID-19 and their newborn babies, with nearly 50 cases of infants now reported. A vertical transmission, from infected mothers, have been reported, but in general they appear to do well. There have been case reports of newborns and very young infants testing positive, and they have not suffered any complications of the disease and required minimal respiratory support [13,14]. Any-way this issue is still not clear and needs more data to be confirmed.

Another interesting issue is the relationship between the disease and the condition of surgical patients, and in particular if the infection can influence the outcomes of surgery. With the explosion of the Sars-Cov-2 pandemic, work has multiplied in the literature on the clinical conditions of infected patients, but only a few of these take surgical patients into consideration. In any case, there are no data that can indicate an involvement with regard to post-operative complications. As far as we know, the case we present in this work is one of the first that concerns a surgical patient in neonatal age and it offers interesting food for thought. For what are the data in our possession we cannot say that the infection has interfered with the regular clinical course of the patient, favoring the appearance of perforation or the onset of post-operative complication. In fact, although the incidence is very low, cases of Meckel's diverticulum perforated in the neonatal period are reported in the Literature, as previously described. Furthermore, the possibility of dehiscence is a widely documented complication and even if the anastomosis has been performed on an otherwise healthy intestine, unlike what happens during NEC for example, this possibility is always to be taken into account. In fact, there are no evident clinical elements related to COVID-19 that can be correlated with a worsening of the patient's general condition and with the onset of dehiscence.

On the other hand, the infection of a patient of this kind has put us pediatric surgeons in front of an unknown reality and has certainly made the management of the patient more difficult. Isolating the patient, although an unavoidable choice, actually complicates the post-operative follow-up that in patients of this age and with this condition requires more assessments per day at the patient's bedside. Furthermore, the fact that these patients, who need urgent surgery, have an infection that is not clinically evident, makes the health workers involved more exposed. It is therefore necessary to create shared protocols in order to perform preoperative screenings that can identify infected patients early, without delaying the time to get to surgery. In conclusion, we can say that in the pediatric field it is necessary to try to share as much as possible the data deriving from the experiences of the individual centers, in order to be able to create shared protocols that can improve the management of these patients and limit the risks for health personnel.

Funding

No funding or grant support.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] Lu X, Zhang L, Du H, et al. SARS-CoV-2 infection in children. *N Engl J Med* 2020.
- [2] KamaliAghdam M, Jafari N, Eftekhari K. Novel coronavirus in a 15-day-old neonate with clinical signs of sepsis, a case report. *Inf Disp* 2020 Apr 1;1-3.
- [3] Zeng LK, Tao XW, Yuan WH, et al. First case of neonate with COVID-19 in China. *ZhonghuaErKeZaZhi* 2020 Apr 2;58(4):279-80.
- [4] Soltero MJ, Bill AH. The natural history of Meckel's diverticulum and its relation to incidental removal. *Am J Surg* 1976;132. 168Y171.
- [5] St-Vil D, Brandt ML, Panic S, et al. Meckel's diverticulum in children: a 20-year review. *J Pediatr Surg* 1991;26. 1289Y1292.
- [6] Meguid M, Canty T, Eraklis AJ. Complications of Meckel's diverticulum in infants. *Surg Gynecol Obstet* 1974;139. 541Y544.
- [7] Aguayo P, Fraser JD, St Peter SD, et al. Perforated Meckel's diverticulum in a micropremature infant and a review of literature. *Pediatr Surg Int* 2009;25. 539Y541.
- [8] Kumar P, Ojha P, Singh UK. Spontaneous perforation of Meckel's diverticulum in a neonate. *Indian Pediatr* 1998;35. 906Y908.
- [9] Bertozzi M, Melissa B, Radicioni M, et al. Symptomatic Meckel's diverticulum in newborn: two interesting additional cases and review of literature. *Pediatr Emerg Care* 2013;(29):1002-5.
- [10] Hillyer MM, Baxter KJ, Clifton MS, et al. Primary versus secondary anastomosis in intestinal atresia. *J Pediatr Surg* 2019 Mar;54(3):417-22.
- [11] Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. *J Am Med Assoc* 2020 February 24.
- [12] Fang F, Luo XP. Facing 2019 novel coronavirus infections: a pediatrician's thinking. *Chin J Pediatr* 2020;58(2):81-5.
- [13] Zeng L, Xia S, Yuan W, et al. Neonatal early-onset infection with SARS-CoV-2 in 33 Neonates Born to mothers with COVID-19 in Wuhan, China. *JAMA Pediatr* 2020 Mar 26.
- [14] Wang X, Zhou Z, Zhang J et al. A case of 2019 Novel Coronavirus in a pregnant woman with preterm delivery. *Clin Infect Dis*, ciaa200.