Original Article

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.91665
Quick Response Code:

Meckel's diverticulum in paediatric practice on Crete (Greece): A 10-year review

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ABSTRACT

Background: Although Meckel's diverticulum (MD) is the most prevalent congenital abnormality of the gastrointestinal tract, it has varied presentations and often becomes a diagnostic challenge. The purpose of this study was to review the diverse presentations of MD, record the epidemiologic features for Crete and review the detection techniques and the treatment options. **Patients and Methods:** This was a review of the records of all children who underwent surgery for MD in the department of Paediatric Surgery of the University Hospital of Crete (Greece) between January 1999 and January 2009. **Result:** A total of 45 patients (32 male and 13 female) aged 1 to 13 years (median 10 years) with a diagnosis of MD were retrospectively reviewed. The collected data were analysed, looking at age, gender, clinical features, investigations, histopathological findings and surgical interventions. In 25 patients, MD was an incidental finding at laparotomy because of appendicitis. The remaining 20 patients were symptomatic and presented with various clinical features. Nine patients (19.9%) had clinical features of peritonitis; of these, three had perforated MD and six had Meckel's diverticulitis at laparotomy. Four patients were diagnosed with intestinal obstruction. Seven patients (15.5%) presented with lower gastrointestinal bleeding. Ultrasound scans revealed intussusception in three patients, requiring open reduction. The remaining four patients with bleeding per rectum underwent a Meckel's Tc99 scan that showed a positive tracer. **Conclusion:** All patients with MD underwent Meckel's diverticulectomy with appendicectomy. MD has an incidence of approximately 1 to 2% in our population. It is necessary to maintain a high index of suspicion in the in the diagnosis of MD paediatric age group because it can be easily misdiagnosed.

Key words: Incidental findings, laparotomy, Meckel's diverticulum, Meckel's scan, paediatric, symptomatic

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INTRODUCTION

Meckel's diverticulum (MD) is one of the most common congenital abnormalities of the gastrointestinal tract, occurring in approximately 2% of the population.[1] Nearly two centuries have passed since its first description by Johan Friederich Meckel.[2] MD is a true intestinal diverticulum that results from the failure of the vitelline duct to obliterate during the fifth week of foetal development. It contains all normal layers of the intestinal wall and, in approximately 50 percent of cases, contains tissue from other sites (ectopic tissue). In the majority of cases, it is asymptomatic. However, it is prone to complications, especially in children, due to ectopic epithelial lining and various bands, reflective of its embryological development. Although the lifetime risk of a Meckel's diverticular complication varies from 4 to 34%,[3] more than 50 to 60% of the patients who develop symptoms are younger than 2 years of age.[4] MD has varied presentations, as several authors have previously demonstrated.[5-8] Harper *et al*. suggested that a bleeding MD should be identifiable scintigraphically using 99mTc pertechnetate, since it is concentrated by gastric mucosa.[9] The Tc99 Meckel's scan has a reported sensitivity of 81 to 90%.[10-13] The purpose of this study was to review the various presentations of MD, to estimate the epidemiologic features and the extent of this clinical entity in Crete (Greece) and to review the detection techniques and treatment options.

MATERIALS AND METHODS

The records of all children who underwent surgery for MD in the department of Paediatric Surgery of the University Hospital of Crete (Greece) between January 1999 and January 2009 were reviewed. This set of records represents the majority of the children with MD on Crete as this department is nonce for all the surgical diseases of children for the whole island, and therefore, for MD. They were analysed with respect to their age at presentation, gender, clinical features, histopathological findings, investigations and surgical intervention performed.

RESULTS

During the above period, 45 children were found to have MD. The youngest child was 1 year old, whereas the oldest was 13 years. There were 32 males and 13 females, giving a male to female ratio of 2.46 : 1. In 25 patients, MD was an incidental finding at laparotomy for some other pathology. The remaining 20 patients were symptomatic and presented with various clinical features. Nine patients (20%) had clinical features of peritonitis; of these, six had Meckel's diverticulitis and three had perforated MD at laparotomy. Four patients (8.9%) were diagnostic with intestinal obstruction and, at laparotomy, a Meckel's band was found to be the cause of the obstruction. Seven patients (15.5%) presented with episodes of bleeding per rectum or melaena [Table 1]. None of these patients required blood transfusion. Ultrasound scans revealed intussusception in three patients, requiring open reduction. The remaining four patients with bleeding per rectum underwent a Meckel's Tc99 scan that showed a positive tracer. All patients underwent successful Meckel's diverticulectomy with appendicectomy. Either in the early postoperative period (until 24 hours after the surgery) or in the late postoperative period, there were no complications.

Histology revealed ectopic gastric mucosa in 18 patients (40%), both located at the proximal and the distal end of the diverticulum. Five patients (11.1%) had a histology result of mucosa of the small intestine, three patients (6.6%) had a histology result of ectopic pancreatic tissue and one patient (2.2%) of both gastric and pancreatic ectopic tissue [Table 2].

DISCUSSION

Though the first recorded observation of an ileal diverticulum has been attributed to Fabricius Hildamus in 1650, Littre reported its presence in a hernia in 1745 and Meckel first described its association with the omphalomesenteric duct. The omphalomesenteric duct connects the yolk sac to the intestinal tract during early foetal life. This structure is usually obliterated by the fifth to seventh week of gestation.[14] Failure to regress may lead to several anomalies including omphalomesenteric fistula, umbilical sinus, umbilical cyst, or MD. The MD may be free (74%) or attached (26%) by fibrous bands to the umbilicus.[3] Persistence of the vitelline arteries may lead to the formation of a mesodiverticular band which can lead to intestinal obstruction.[15] MD is the most common congenital malformation of the small intestine, affecting about 2% of the population.[6] Only 4 to 6% of MD is known to be symptomatic[6,16] and the presentations can be quite varied. The male to female ratio is reported as 2 : 1 to 4 : 1,[5,6,17] which is in keeping with the ratio seen in our series. Some series found ileus, due to adhesive bands, to be the most common presentation in patients below ten years of age and haemorrhage in patients below 20 years of age.[7] However, we found peritonitis to be the most common symptomatic presentation of MD, especially in children below ten years of age. This likely reflects the high incidence of ectopic gastric mucosa encountered in our series and the ulceration that this creates.

Although most authors would recommend resection of an incidentally detected MD at laparotomy,[1,17] others advocate their resection only in selected cases of MD which are suspected of having ectopic gastric mucosa or forming adhesive bands.[5] In our series, all 25 patients who had their MD detected incidentally during laparotomy underwent diverticulectomy. Those MD patients with clinical features of peritonitis are often mistakenly diagnosed as perforated appendicitis. At laparotomy, of the nine patients with peritonitis, three had a perforated MD and six had Meckel's diverticulitis. There were no cases of concurrent appendiceal pathology. Similarly, in cases of intestinal obstruction due to a Meckel's band, the cause is often not found until the band is directly visualised.

Diagnosis and management of complicated or incidental MD in children has undergone significant changes in the minimal access era**.** The diagnosis of Meckel's diverticular complications, based on clinical features and conventional radiological modalities, is fraught with limitations as MD is a mobile structure and mimics other common conditions. Meckel's diverticular bleeding, the commonest presentation related to

Table 1: Clinical image

Clinical image	No. of patients	Percentage
LGI bleeding	7	15.5
Diverticulitis	6	13.3
Obstruction	4	8.9
Perforation	3	6.7
Asymptomatic	25	55.6

Table 2: Histopathological findings

Mucosa type	No. of patients	Percentage
Gastric	18	40
Small intestine	5	11.1
Pancreatic	3	6.6
Gastric and pancreatic	1	2.2

complicated MD, ranges from 1 to 10%, but should be less in this modern era of early diagnosis and minimal invasive therapy.[18]

In diagnosis, the most precise test in childhood is gammagraphy with Tc99m pertechnetate (Meckel's scan). Other imaging methods such as ultrasonography, computer tomography, barium meal and angiography can rarely diagnose this condition.[14,19] The prerequisite for the detection of an MD by Tc99 sodium pertechnetate scintigraphy is the presence of ectopic gastric mucosa. The high affinity of this isotope for parietal cells of gastric mucosa permits visualisation of both eutopic and ectopic gastric tissue. The residual isotope is concentrated in the urinary bladder. A positive scan shows abnormal uptake of the isotope outside the stomach and urinary bladder. The Meckel's scan has a reported sensitivity of 81 to 90%.[10-13] The incidence of ectopic gastric tissue in MD in symptomatic patients is reported to be 45 to 80%.[7,8,20] Haemorrhage usually occurs secondary to ectopic gastric mucosa. Diverticulitis commonly occurs secondary to acid secretion from ectopic gastric mucosa. The presence of ectopic mucosa, particularly pancreatic, is also a predisposing factor for intestinal obstruction. The incidence of ectopic mucosa in MD is reported in the literature from 15 to 50%[3,21-23] depending on the percentage of incidental or autopsy cases in each series. Mackey and Dineen[24] reported a 16.4% and 34% incidence of ectopic mucosa in asymptomatic and symptomatic Meckel's diverticulae, respectively. Artigas *et al*.[15] concluded that the presence of ectopic tissue in patients with MD seems to be the main risk for occurrence of an acute non-mechanical complication. Ectopic gastric tissue is found in 60 to 82%, pancreatic in 1 to 16% and both in 5 to 12% of cases. Other less common tissues include colonic, duodenal and biliary.[3,25,26] Reported mortality and morbidity for MD are 6 to 7.5% and 6 to 30%, respectively. In our series, there were no deaths.

It is well accepted that incidental MD should not be removed from patients older than 40 years,[27,28] but no specific guidelines exist for the paediatric population. Several authors[21,29,30] suggest removal of all asymptomatic Meckel's diverticulae because of high risks of complication and the low risks associated with resection. However, Soltero and Bill,[16] using lifetime risk tables, found that to prevent one death, 800 cases of incidental Meckel diverticulectomy would need to be performed. They suggested that incidental removal is not justifiable unless obvious risk factors are present. The accepted risk factors are suspicion of ectopic mucosa on palpation, fibrous bands to the umbilicus, mesodiverticular bands, or the presence of surrounding inflammation.[15,16,31,32] A review of 1 476 patients showed a 20% morbidity and 3% mortality for resection of an asymptomatic MD and a 13% morbidity and 0% mortality in symptomatic patients. The authors of the study observed that patient aged <50 years, male gender, diverticula longer than 2 cm and ectopic mucosa or abnormal features within a diverticulum were all characteristics seen more commonly in symptomatic patients.[33] A smaller series (47) including all patients who had undergone removal of a MD over a 10-year period in a single institution also concluded that male patients were more likely to develop symptoms. The authors recorded a surgical complication rate of 8.5% and recommended that if asymptomatic diverticula are encountered, they should not be routinely resected, especially in female patients.[34]

In conclusion, MD is a lesion present in approximately 1 to 2% of the general population. MD has various presentations and can be easily misdiagnosed. It is necessary to maintain a high index of suspicion in the paediatric age group.

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Cite this article as: Blevrakis E, Partalis N, Seremeti C, Sakellaris G. Meckel's diverticulum in paediatric practice on Crete (Greece): A 10-year review. Afr J Paediatr Surg 2011;8:279-82.

Source of Support: Nil. **Conflict of Interest:** None declared.