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The incidence, gross and histological features of Meckel's diverticulum: A cadaveric study

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ABSTRACT

Background: Meckel's diverticulum (MD) develops from persistent omphalomesenteric duct and is an uncommon finding in females. Our aim is to report the incidence of finding of MD in cadavers and to study its gross and histological feature.
Materials and Methods: The observational study was conducted in 60 cadavers over a period of nine years. In the present study a meckel's diverticulum was detected in sixty years old female cadaver.
Result: The diverticulum was 63 cm proximal to ileocecal junction. It was 6 cm in length and 3.5cm in width and its tip free from any connections. Histologically, it showed four layers of ileum and patchy areas of coagulative necrosis in the mucosa.
Conclusion: These uneventful Meckel's diverticulum findings of meckel's diverticulum should be reported from time to time in particular population which may be beneficial for the surgeons and radiologists.

1. Introduction

As far as gastrointestinal tract is concerned, Meckel's diverticulum is the most common congenital anomaly, which occurs when vitellointestinal duct (VI) is not obliterated completely.[1] It is characterized by rule of two which means it occurs in 2% population, 2 feet proximal to ileo-caecel valve, 2 inches long. It may contain two types of tissues namely gastric mucosa and pancreatic tissue.[2] It is usually attached to the antimesenteric border of the ileum, and usually disappears during the 6th week of intrauterine life. Its calibre is almost equal to that of the ileum and it has separate mesentery for passing blood vessels supplying it. It has four layers histologically, similar to the layers of gastrointestinal tract.

It may give rise to certain complications like gastrointestinal (GI) bleeding and faecal fistula at the umbilicus. If entire VI duct remains patent, invaginations, obstruction, ulceration, perforation, vesicodiverticular fistula, tumours, abdominal pain due to acid secretion from gastric mucosa of it, strangulation, hernia, intussusceptions, volvulus etc may occur as complications.[3,4] As the age advances, risk for complication progressively declines.[5] The risk of developing complications with signs and symptoms is estimated at about 4.8% of the population having the anomaly.[5,6]

The probability of pre-operative diagnosis has improved significantly on account of wide spread use of various advanced diagnostic modalities like technetium-99m pertechnate scan and diagnostic laparoscopy.[7]

The aim of the present study is to estimate incidence among Indian cadavers and to observe its gross and microscopic features to assist in better diagnosis and management of the cases of Meckel's diverticulum.

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2. Materials and Methods

The observational study was conducted in the department of anatomy AIIMS, Raipur in sixty cadavers in which twenty six were females and thirty four were males. The study period was year 2012-2021. After cadaveric laparotomy, we looked for presence or absence of MD. Subsequent to complete gross observation of MD, a portion of the tissue was processed for histological examination. Haematoxylin & Eosin staining was done for examining its different layers and ectopic mucosa.

3. Result

3.1. Incidence

This was found in a female cadaver of 60 years of age. The total incidence of MD was 1/60 ie 1.6% and the incidence among females was 1/26 ie 3.8%.

3.2. Gross observation

MD was located 63 cm proximal to the ileocecal junction on antimesenteric border of ileum. It was 6 cm in length from the base. It was free from connection to umbilicus or to any other parts of intestine. It had a stem and rounded top. Breadth at the base was 1.7 cm and on the top 3.5 cm. Grossly, no scar or defect was found. On cutting the MD, the lumen of the stem showed mucosal folds, however, no mucosal fold was found in the lumen of the top (Figure 1).

3.3. Histological feature

The wall of MD had four layers namly Mucosa with villi, submucosa, muscularis externa and serosa were seen. Lymphatic follicles were also seen in the submucosa. Mucosal lining was simple columnar epithelium. It was ulcerated at places showing coagulative necrosis. It was infiltrated with lymphocytes, plasmocytes and few neutrophils suggestive of inflammation. There was no ectopic tissue such as pancreatic or gastric tissue (Figure 2).

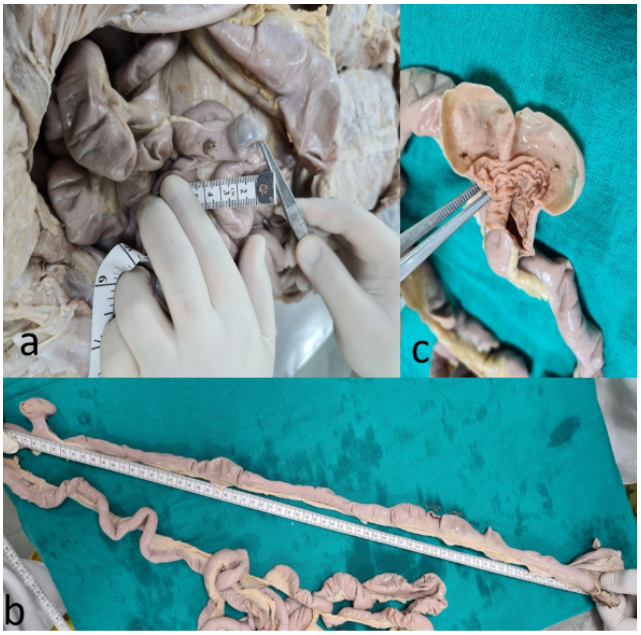

Figure 1: Showing gross features of Meckel's Diverticulum; **a:** In situ meckel's diverticulum; **b:** Ex situ meckel's diverticulum; **c:** Open lumen of meckel's diverticulum.

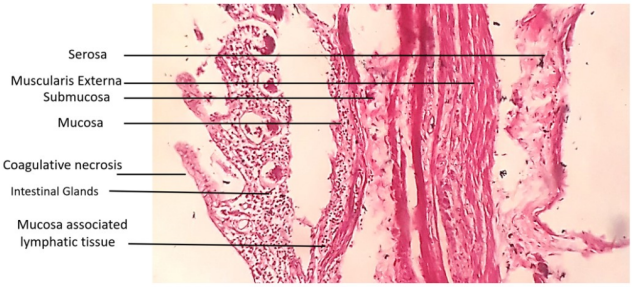

Figure 2: Histological features of Meckel's diverticulum

4. Discussion

Meckel's diverticulum is an outpouching and the commonest congenital anomaly of the digestive tract. Meckels diverticulum was first described in 1809 by the Johann Friedrich Meckel, the German anatomist, who stated it as a remnant of the omphalomesenteric duct.[8] Standring et al, Sager et al and Wahengbam et al. found incidence of MD as 3%, 0.6-4% and 2.22% respectively[7,9,10]. In the current study, the incidence was 1.6%. The literature showed that it is 3-5 times more prevalent in male than female with male to female ratio (4:1).[11] In our study, it was found in a female which is rare occurrence. Many authors have stated that complications are more frequently seen in males than in females, therefore more often detected in the males.[12–14] Most of the diverticula (90%) are located within 90 cm distance from ileocaecal valve, however, some diverticula may be seen upto 180 cm from ileocaecal valve.[15] Wahengbam et al. found it, 99cm away from iliocaecal junction in a cadaveric study.[10] In the present study, the diverticulum was observed at 63 cm.

Average length of MD in various studies is 3cm with range from 1to12cm. Akbulut and Yagmur have reported 8 cm long MD[16] whereas Nayak has reported 7.5 cm long.[17] In the current study it was 6 cm in length and ratio of hight to max diameter was <2. These findings suggest that the surgery is not required in this case. Long diverticulum which has height to diameter ratio of >2 and has ectopic tissue present at the stem and top is indication for surgery.

The histological structure of the diverticulum is the same as that of the small intestine, namely, which means it

was composed of mucous membrane, submucosa, muscular layers and serosa from the inside out. In the present study, the mucosa was lined by the columnar epithelium with goblet cells and ill-defined villi as also seen in normal ileal mucosa. Ectopic gastric, duodenal, endometrial mucosa or pancreatic tissue may be found in some cases.[18] But in the present study, such ectopic tissue was not found. Our histological findings were similar to the findings of Wahengbam et al.[10]

There is a 4-6% risk of developing a complication in a person with meckel's diverticulum.[15] In adult, overall, the most common complication is intestinal obstruction and inflammation.[19] Incidence of developing a complication is three to four times more in males, although its occurrence in males and females is equal.[20] Bleeding is the commonest complication in children with ectopic gastric gland in MD.[19]

Many studies showed MD with ectopic gastric mucosa with symptom, without symptom or undiagnosed.[17,20] As age advances, the risk of developing complications decreases, however there are no predictive factors for the development of complications.[21,22] In the present study, tissues of diverticulum showed minor signs of inflammation, which denotes that mild complication had probably occurred.

Still there are many cases of MD misdiagnosed or not diagnosed before any diagnostic interventions. The preoperative confirmation is a big challenge in front of clinicians.[7] In a suspected case of MD, laparoscopy is the preferred diagnostic modality.[23] however, the most accurate and non-invasive investigation for such cases is the technetium-99 m pertechnate scan. In patients with non-bleeding symptoms and where technetium-99m pertechnate scan is not diagnostic, ultrasonography is also a useful non-invasive diagnostic modality.[24]

Charles mayo stated very aptly that MD is frequently suspected, often looked for and seldom found.[25] In the study of 776 patients, Kusumoto et al. found that 88% patients presenting with bleeding had a correct preoperative diagnosis than the 11% with other symptoms rather than bleeding.[26] Technetium-99m pertechnate scan is specific to ectopic gastric mucosa and not specific to mecklel's diverticulum, it may be positive in condition like gut duplication cysts with ectopic gastric mucosa.[27]

The surgical resection is the treatment of choice for the symptomatic MD. Treatment plan for symptomatic MD is diverticulectomy, wedge resection and segmental resection. Type of surgical resection depends on various factors like presence and absence of ectopic tissue, integrity of diverticulum and adjacent part of small intestine. Mackey and Dineen stated that the statistically significant risk factors include males less than 40 years old, more than 2 cm long MD and presence of ectopic tissue[28] Onen et al. suggested its removal in children less than 8 years of age with or without symptoms[29] to avoid risk of future complication which is debatable in view of overall quit low rate of complication.

5. Conclusion

In the current study, the female was most likely asymptomatic or mildly symptomatic till death. Nonspecific signs and symptoms of acute abdomen are big challenge for the clinician in diagnosing MD. The baseline data of meckel's diverticulum in Chhattisgarh would have significant impact in clinical practice. By this study, we wish to report a rare case of MD i.e. an uncomplicated MD in a female without ectopic mucosa. Adequate knowledge of embryology, radiology, pathology, clinical features and incidence of MD are paramount importance early diagnosis and effective surgical management of cases with complications.

6. Author's Contribution

1. Conceptualization: MBS
2. Drafting of Manuscript MBS, RU
3. Critical revision of the manuscript: HPS
4. Conflict of interest: No potential conflict of interest was reported.

7. Abbreviations

MD - Meckel's diverticulum, VI - Vitellointestinal duct

8. Source of Funding

None.

9. Conflict of Interest

None.

References

1. Uppal K, Tubbs RS, Matusz P, Shaffer K, Loukas M. Meckel's diverticulum: a review. *Clin Anat*. 2011;24(4):416–22.
2. Walczak DA, Falek W, Zakrzewski J. An uncommon location of Meckel's diverticulum or small intestine duplication? Case report and literature review. *Pol Przegl Chir*. 2011;83(8):457–60.
3. Chan KW, Lee KH, Mou JW, Cheung ST, Tam YH. Laparoscopic management of complicated Meckel's diverticulum in children: a 10-year review. *Surg Endosc*. 2008;22(6):1509–12.
4. De Beule T, de Beeck K, Hertogh GD, Sergeant G, Maleux G, et al. CT diagnosis of a post-embolization ischemic diverticulitis of Meckel. *Acta Radiol Short Rep*. 2014;3(9):2047981614531954. doi:10.1177/2047981614531954.
5. Soltero MJ, Bill AH. The natural history of Meckel's Diverticulum and its relation to incidental removal. A study of 202 cases of diseased Meckel's Diverticulum found in King County, Washington, over a fifteen year period. *Am J Surg*. 1976;132(2):168–73.
6. Park JJ, Wolff BG, Tollefson MK, Walsh EE, Larson DR. Meckel diverticulum: the Mayo Clinic experience with 1476 patients. *Ann Surg*. 1950;241(3):529–33.
7. Sagar J, Kumar V, Shah D. Meckel's diverticulum: a systematic review. *J R Soc Med*. 2006;99(10):501–5.

8. Meckel JF. Uber die divertikel am darmkanal. *Arch Physiol*. 1809;9:421–53.
9. Standring S. Gray's Anatomy. In: The anatomical basis of clinical practice. 39th edn. London: Elsevier Churchill Livingstone; 2005. p. 1167.
10. Wahengbam S, Daimei T, Devi KA, Tunglut J. Meckel's diverticulum: The incidence, gross and microscopic features: A cadaveric study . *Indian J Anat Res*. 2018;6(3.1):5477–80.
11. Bemelman WA, Hugenholtz E, Heij HA, Wiersma PH. Obertop H Meckel's diverticulum in Amsterdam: experience in 136 patients. *World J Surg*. 1995;19(5):734–42.
12. Arnold JF, Pellicane JV. Meckel's diverticulum: A ten year experience. *Am Surg*. 1997;63(4):354–5.
13. Mackey WC, Dineen P. A fifty year experience with Meckel's diverticulum. *Surg Gynecol Obstet*. 1983;156(1):56–64.
14. Cullen JJ, Kelly KA, Moir CR, Hodge DO, Zinsmeister AR, Melton LJ, et al. Surgical management of Meckel's diverticulum. An epidemiologic, population-based study. *Ann Surg*. 1994;220(4):564–8.
15. Williams RS. Management of Meckel's diverticulum. *Br J Surg*. 1981;68(7):477–80.
16. Akbulut S, Yagmur Y. Giant meckel's diverticulum: An exceptional cause of intestinal obstruction. *World J gastrointest Surg*. 2014;6(3):47–50.
17. Nayak BS, Shetty P, Sirasanagandla SR, Kumar N, Aithal AP. Histomorphological study of a giant Meckel s diverticulum with gastric type of mucosa. *J Morphol Sci*. 2016;33(2):108–11.
18. Stone PA, Hofeldt MJ, Lohan JA, Kessel JW, Flaherty SK. A rare case of massive gastrointestinal hemorrhage caused by Meckel's diverticulumin a 53-yearold man. *W V Med J*. 2005;101(2):64–6.
19. Blouhos K, Boulas KA, Tsalis K, Barettas N, Paraskeva A, Kariotis I, et al. Meckel's diverticulum in adults: surgical concerns. *Front Surg*. 2018;5:55. doi:10.3389/fsurg.2018.00055.
20. Lichtstein DM, Herskowitz B. Massive gastrointestinal bleeding from Meckel's diverticulum in a 91- year-old man. *South Med J*. 1998;91(8):753–4.
21. Fich A, Talley NJ, Shorter RG, Phillips SF. Does Helicobacter pylori colonize the gastric mucosa of Meckel's diverticulum? *Mayo Clin Proc*. 1990;65(2):187–91.
22. Hill P, Rode J. Helicobacter pylori in ectopic gastric mucosa in Meckel's diverticulum. *Pathology*. 1998;30(1):7–9. doi:10.1080/00313029800169585.
23. Shalaby RY, Soliman SM, Fawy M, Samaha A. Laparoscopic management of Meckel's diverticulum in children. *J Pediatr Surg*. 2005;40(3):562–7.
24. Daneman A, Lobo E, Alton DJ, Shuckett B. The value of sonography, CT and air enema for detection of complicated Meckel diverticulum in children with nonspecific clinical presentation. *Pediatr Radiol*. 1998;28(12):928–32.
25. Stone PA, Hofeldt MJ, Campbell JE, Vedula G, Deluca JA, Flaherty SK, et al. Meckel diverticulum: ten-year experience in adults. *South Med J*. 2004;97(11):1038–41.
26. Kusumoto H, Yoshida M, Takahashi I, Anai H, Maehara Y, Sugimachi K, et al. Complications and diagnosis of Meckel's diverticulum in 776 patients. *Am J Surg*. 1992;164(4):382–3.
27. Kumar R, Tripathi M, Chandrashekar N, Agarwala S, Kumar A, Dasan JB, et al. Diagnosis of ectopic gastric mucosa usFing 99Tcm-pertechnetate: spectrum of scintigraphic findings. *Br J Radiol*. 2005;78(932):714–20.
28. Mackey WC, Dineen P. A fifty year experience with Meckel's diverticulum. *Surg Gynecol Obstet*. 1983;156(1):56–64.
29. Onen A, Cigdem MK, Ozturk H, Otcu S, Dokucu AI. When to resect and when not to resect an asymptomatic Meckel's diverticulum: an ongoing challenge. *Pediatr Surg Int*. 2003;19(1-2):57–61.

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