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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI:10.21474/IJAR01/13717
DOI URL: http://dx.doi.org/10.21474/IJAR01/13717

RESEARCH ARTICLE

SYMPTOMATIC MECKEL'S DIVERTICULUM IN THE NEWBORN: REVIEW OF THE LITERATURE

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Manuscript Info

Manuscript History
Received: 05 September 2021
Final Accepted: 10 October 2021
Published: November 2021

Key words:-
Newborn, Meckel Diverticulum, Symptomatic, Omphalo-Mesenteric Duct, Obstruction, Perforation

Abstract

Meckel's diverticulum accounts for 2 to 3% of gastrointestinal tract malformations in children. It is a distal remnant of the incompletely obliterated omphalo mesenteric duct that occurs at 4 weeks\' gestation, and is located approximately 40 to 60 cm from the last ileal loop. In the majority of cases, its presentation is asymptomatic and discovery is incidental. The symptomatic form represents 4% and is rare in children, including bleeding, occlusion, inflammation and intermittent umbilical oozing. The symptomatic form is exceptional in newborns. This work is a descriptive study of the literature regarding reported cases of newborns diagnosed with symptomatic Meckel\'s diverticulum either as a picture of intestinal obstruction or by spontaneous perforation of the DM The objective of our study is to describe the cases of newborns operated in emergency for symptomatic Meckel\'s diverticulum and to evaluate the surgical management.

Introduction:-

Meckel's diverticulum accounts for 2 to 3% of gastrointestinal tract malformations in children.

It is a distal remnant of the incompletely obliterated omphalo mesenteric duct that occurs at 4 weeks' gestation, and is located approximately 40 to 60 cm from the last ileal loop.

In the majority of cases, its presentation is asymptomatic and discovery is incidental. The symptomatic form represents 4% and is rare in children, including bleeding, occlusion, inflammation and intermittent umbilical oozing. The symptomatic form is exceptional in newborns.

This work is a descriptive study of the literature regarding reported cases of newborns diagnosed with symptomatic Meckel's diverticulum either as a picture of intestinal obstruction or by spontaneous perforation of the DM

The objective of our study is to describe the cases of newborns operated in emergency for symptomatic Meckel's diverticulum and to evaluate the surgical management.

Patients and Methods:-

We performed a search in the "MEDLINE" database, "SCOPUS" from initial date 1988 to until 2012, with the following keywords: "newborn AND symptomatic Meckel's diverticulum" and "newborn AND complicated Meckel's diverticulum" in French and in English.

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We were thus able to group 34 articles dealing with this subject for which demographic, clinical, therapeutic and evolutionary data were analyzed; 1st degree references were also analyzed.

Results:-

We grouped 36 newborns with symptomatic Meckel's diverticulum, of which 12 were non-perforated Meckel's diverticula and 24 perforated.

A male predominance was noted: 5 boys for one girl.
The average age at diagnosis was 5.72 days (minimum H3 and maximum 24 days) with a median of 4 days.

The mean gestational age was 35.9 days, the lowest was 26 days and the highest was 41 days.

The average birth weight is 2043g; the minimum weight is 500g and the maximum weight is 4500g.

All newborns in the 1st category (n=12) (non-perforated Meckel's diverticulum) presented with associated bilious vomiting in:
- 2 newborns: medium to heavy rectal bleeding.
- 1 newborn: lethargy
- 1 newborn presented a pneumo scrotum with abdominal distension
- 1 newborn: palpable mass on the right
- 2 newborns presented with acute intestinal invagination

16 newborns in the 2nd category (n=24) (perforated Meckel's diverticulum) presented with pneumoperitoneum on standard abdominal-pelvic radiography, i.e. 66.6%:
- 1 newborn with sepsis
- 4 newborns presented with a picture of low neonatal occlusion without pneumoperitoneum, i.e. 16.6%.

- 2 neonates presented with meconium discharge through the omphalocele; 1 neonate had an antenatal diagnosis of anencephaly and
omphalocele
- Associated malformations were found in 3 cases, i.e. 13%, distributed as follows
1. Hirschsprung's disease in 1 case
2. "VACTERL" syndrome in 1 case
3. Omphalocele and anencephaly in 1 case
4. Omphalocele in 1 case

- 1 case of a SARS-COV2 positive newborn was reported

In our study; 15 premature newborns with gestational age ≤37SA or 40% having as characteristic of the pregnancy:
- 1 case of oligohydramnios
- 1 case of bleeding and failure of tocolysis
- 1 case of maternal HELLP syndrome
- 1 case of maternal pyelonephritis and appendicitis
- 1 case Circular cord
- 1 case Twin pregnancy
- 1 case of prolonged laborious delivery

31 newborns benefited from a terminal resection-anastomosis taking away Meckel's diverticulum; in 5 newborns, a stoma was performed and then re-established.

The anatomopathological study revealed:
- The presence of gastric heterotopia in 5 cases (15.15%)
- The presence of pancreatic heterotopia in 2 cases (6%)
- No tissue heterotopy in 14 cases (42.42%)
- The maximum reported size of the Meckel Diverticulum is 6cm*5cm and the minimum 1.5cm*1.7cm
- The Meckel Diverticulum was found from 20cm to 60cm from the last ileal loop.

The evolution was favorable in the majority of cases:
- 1 case of release having benefited from ileostomy then recovery after 3 weeks
- 1 case of sepsis requiring a 28-day postoperative stay.

The tables below summarize the data from our results:

Table A: Cases of newborns with imperforate Meckel's diverticulum complicated by intestinal obstruction (NR= not reported; M= Male; F= Female.

	Sex	Gestational age(SA)	Weight(g)	Age(Days)	Clinicalpresentation	Contents of theDM	DM size Incm	Tissueheterotopia	Typeofobstruction
Leconteandal,1988**[1]**	M	NR	NR	8	Vomitingsbilious	NR	6*5	No	Compression extrinsic
Fromthe Hunt1993**[2]**	M	33	1955	10	Vomitingsbilious	Curdledmilk	10	Gastric	Compression intraluminal
Goyal etal1993**[3]**	NR	NR	NR	24	Drowsinessand vomitings	NR	1.5*1.7	No	Iliumsuture
Donnellyetal,1998**[4]**	NR	NR	500	NR	Vomitingbiliousness and rectalbleeding	NR	NR	NR	Intraluminalcompression
Sy etal,2002**[5]**	M	36	2520	1	Straight massandileus	Blooddigested/meconium	6*4*3	No	Volvulus
TaekYuandal2005**[6]**	M	39	3920	1	Vomitingsbilious	NR	3*3*2	No	Invagination
Sinhaetal, 2009**[7]**	M	36	2700	6	Biliousvomiting	NR	6*4*3	No	Intraluminal Compression
	M	41	3420	5	Biliousvomiting Rectorrhagia massive		2.5*4*3	Gastric	NR
*Bertozziandal2013***[8]**	M	38	3400	15	Vomitingsbilious	Mucus	3*3*2	Gastric	NR
KumarDas **[9]** etal2015	F	Eventually	2854	20	Biliousvomiting	NR	3.4	NR	Invagination
LouatiH and Al2017**[10]**	M	Eventually	2350	1	Biliousvomiting	NR	NR	NR	Invagination
Oukhouya MA etal2018**[11]**	M	NR	NR	6	Biliousvomiting	NR	3*2*3	NR	Iliumsuture

Table B: Cases of newborns with Meckel's diverticulum complicated by **perforation**:(NR= not reported; M= Male; F= Female)

Author	**Sex**	**Gestational age (SA)**	**Weight(g)**	**Age**	**Clinicalpresentation**	**Tissueheterotopia**	**Histology**	**Malformativeassociation**
Coppesetal,1991**[12]**	M	32	1780	3	Pneumo-scrotum/pneumoperitoneum	No	Inflammationandnecrosis	No

Ford1992**[13]**	NR	37	1900	1	Pneumoperitoneum	Pancreatic	Inflammationandnecrosis	VACTERLsyndrome
Yeh et al,1996**[14]**	M	NR	NR	8	Obstructionintestinal	No	Inflammationandnecrosis	No
Gandyandal, 1997**[15]**	M	Term	4500	4	Intestinalobstruction	Pancreatic	Inflammation	No
Kumaret al,1998**[16]**	M	NR	2300	5	Intestinalobstruction	No	Noinflammation	No
Zahraaet al,2003**[17]**	NR	Atterm	2070	3	Sepsis	No	Inflammation	No
Sy etal, 2006**[18]**	F	40	3200	3	Pneumoperitoneum	No	Inflammation	Hirschsprungdisease
Changet al,2006**[19]**	M	33	2040	1	Pneumoperitoneum	No	Muscledefect	No
Oyachiet al,2007**[20]**	M	Term	3060	17	Intestinalobstruction	No	Inflammation	No
Aguayoet al,2009**[21]**	NR	28	810	6	Pneumoperitoneum	No	Inflammation	No
Alkanet al,2009**[22]**	F	38	2800	1	Pneumoperitoneum	No	Inflammation	No
Khan et al2012**[23]**	F	29	650	6	Pneumoperitoneum	NR	Inflammation	No
*Bertozzietal2013***[24]**	M	34	2500	5	Pneumoperitoneum	No	withoutinflammation	No
*SCranksonetal 2013***[25]**	M	Eventually	NR	2	Pneumoperitoneum	NR	NR	No
Smolkinetal2013**[26]**	M	28	1200	5	Pneumoperitoneum	NR	NR	No
	M	26	750		Pneumoperitoneum	NR	NR	No
*Borji et al2014***[27]**	M	29	1400	H3	Pneumoperitoneum	NR	NR	No
*Alvares Al2015***[28]**	M	30	940	10	Pneumoperitoneum	Gastric	Diverticulitisandsevere peri-ulcerationdiverticular	No
Orelaruet Al2018**[29]**	M	32	1300	3	NR	NR	Inflammation Necrosis	No

Wang YJet al2019 **[30]**	M	27	1370	1	Pneumoperitoneum	No	Inflammation	No
McKelvieetal 2019 **[31]**	F	30	1200	3	Pneumoperitoneum	Gastric	Inflammation	No
TaziMandal 2019**[32]**	M	Eventually	3500	1	Ruptured Omphalocele	Meconium	3.5	Omphalocele
Bindi. etal2020 **[33]**	M	Eventually	NR	3	Pneumoperitoneum	NR	NR	No SARSVOC2Positive
UrrutiaSotoetal2021**[34]**	M	Eventually	NR	1	Meconiumdischargefromthe omphalocele	NR	NR	Anencephalyandomphalocele

Discussion:-

Meckel'sdiverticulum(MD)resultsfromincompleteregressionoftheyolkductotherwiseknown as the omphalo mesenteric duct; this obliteration anomaly occurs around the 5thSA[35]

TheDMmostcommonlypresentsas ablindpouchattachedtotheanti-mesentericrimcentred by a feeding artery. It varies in size and may be connected to the posteriorabdominalwallby afibrous flangeorremnant [36]

DMisacommon malformationofthegastrointestinaltractinchildren representing2%.Itis symptomatic in 60% after the age of 3 years with a male predominance; thesymptomatic presentation of DM is: hemorrhage 40%; intestinal obstruction 30% anddiverticulitis20% [37].

ThetoptwomechanismsofdigestiveobstructionoftheDMisacuteintestinalintussusception and volvulus (46% and 24% respectively); other less common mechanismsareinternal herniationand inflammationoftheDM [38]

TheoccurrenceofDMperforationis10%ofsymptomaticchildren inthe firstyearoflife[39]

There are few published cases and case series on symptomatic neonatal DM and this isnecessarilyexplainedbythe rarityofDMasanetiologyresponsible forneonatalocclusion(etiologiesof lowerneonatal occlusions,ulcerativenecroticperitonitis)

Inour study,36 cases ofnewborns operatedforsymptomaticDMwereidentified anddividedintotwocategories:

1. Category 1: the DM is symptomatic and not perforated
2. Category 2: the DM is symptomatically perforated

Our study included very low birth weight babies (Minimal: 500g) with extremes ofprematurity at26SA.Antenataldiagnosis was reportedin2cases.

Maternal complications (HELLP syndrome; cord circular; bleeding) were reported in 6preterminfants,suggestinganassociation betweenpregnancyandmaternalcomplicateddelivery and neonataldistress andDMperforationin preterminfants.

The main clinical presentation all ages combined was bilious vomiting and abdominaldistension first; 2 cases presented with small to large amounts of rectal bleeding and

1casewasadmittedwithsepsis.Prematurebabieswereadmittedwithocclusivesyndromeandassociatedrespiratorydistress.

Theinitialmanagementtookplaceina neonatalintensivecareunitwithgoodconditioning. Borgietal,wasthe1stto performalaporotomyinthepreterminfantand foundthatrespiratory distress is more of a direct consequence of abdominal distension byperforation ofthe DM [27]

Ford and Woolley 10, suggested that excessive ventilation in babies with esophagealfistulasislikelytoresultinDMperforation;thisisincreasedbythe coexistenceofanalimperforation[13].

Theradiologicalworkuprevealedpneumoperitoneumin16newbornsandvariable numbersofhydroaerosal levels inthe colonand the small intestine intheothercases.

Surgicalexplorationobjectified:

- DM located 20-60 cm from the last ileal loop
- 3 cases of acute intestinal invagination on a non-perforated DM
- 1 case of volvulus on DM with fibrous flanges no perforated.
- 24 perforated DMs
- Almost the majority of newborns have had terminal resection- anstomosis with the DM removed.
- Tissue heterotopia is present in 7 cases
- Inflammation, necrosis and hemorrhage are almost present in the histological study

The postoperativeevolution wasfavorablein themajorityofcaseswith an averagestayof7 days,whichsuggeststhattheone-stagetreatmentbyterminalanastomosisresectioneveninprematureandvery lowbirthweight babies is effective.

Conclusion:-

SymptomaticMeckel'sDiverticulumisa rareandheterogeneousentityinthenewborn.It can take on several clinical presentations but the most common presentation isneonatal obstruction associated with respiratory distress in premature and low birthweightbabies.

Theassociationwithmaternalstressduringpregnancyanddeliveryhasbeen describedandremains anavenuetobe exploredas toitslink withDM perforation.

ApartfromitsraresymptomaticcharacterthediagnosisofasymptomaticDMshouldalways be suspectedtoensureearly andappropriate surgicaltreatment.

References:-

1. Leconte D, Van Kote G, Questaux E, et al. A rare cause of neonatal occlusion by a palpableabdominalmass:Meckel'sdiverticulum.ChirPediatr.1988;29:216Y218.
2. delaHuntMN,Range croftL.IntraluminalmilkcurdobstructioninagiantMeckel'sdiverticulum.JPediatrSurg.1993;28:955Y956.
3. Goyal MK, Bellah RD. Neonatal small bowel obstruction due to Meckel diverticulitis:diagnosisbyultrasonography.JUltrasoundMed.1993;12:119Y122.
4. Donnelly LF, Johnson JF 3rd. Case report: inverted Meckel's diverticulum with associatedmicrocolon. ClinRadiol.1998;53:226Y227.
5. SyED,ShanYS,TsaiHM,etal.Meckel'sdiverticulumassociatedwithilealvolvulusinaneonate. PediatrSurgInt.2002;18:529Y531.
6. TaekYu, M.D.,YeonKyunOh, M.D.,WonChurlPark, M.D.*EunAKim,M.D.†,ChangWooLee,

7. M.D. and Hyang Suk Yoon, M.D A Case of Intussusception Caused by Meckel's Diverticulum in aNewbornSeungKoreanJPediatr2005;48:907-910)
8. Sinha CK, Fishman J, Clarke SA. Neonatal Meckel's diverticulum: spectrum ofpresentation.PediatrEmergCare.2009;25:348Y349.
9. Bertozzi M, Melissa B, Radicioni M, Magrini E, Appignani A. Symptomatic Meckel'sdiverticulum in newborn: two interesting additional cases and review of literature. PediatrEmerg Care. 2013 Sep;29(9):1002-5. doi: 10.1097/PEC.0b013e3182a315e5. PMID:24201981.
10. Kumar Das D, Kumar Majumdar P, Shukla S. Meckel's Diverticulum causingIntussusceptioninaNewborn.JNeonatalSurg.2015;4(4):46.Published2015Oct
11. LouatiH,ZouariM,JallouliM,BenDhaouM,Zitouni H, MhiriR.PerforatedMeckel'sdiverticulumcausingIntussusceptioninaneonate. JNeonatSurg.2017;6:73.
12. Oukhouya MA, Andaloussi S, Abdellaoui H, Tazi M, Mahmoudi A, Elmadi A, KhattalaK, Bouabdallah Y. Meckel's diverticulum causing intestinal obstruction in the newborn.PanAfr Med J. 2018 Nov 28;31:210. doi: 10.11604/pamj.2018.31.210.14840. PMID:31447969;PMCID:PMC6691295.
13. Coppes MJ, Roukema JA, Bax NM. Scrotal pneumatocele: a rare phenomenon. JPediatr Surg.1991;26:1428Y1429.
14. Ford EG, Wooley MM. Tracheoesophageal fistula associated with perforated Meckel'sdiverticulum.JPediatrSurg.1992;27:1223Y1224.
15. Yeh JT, Lai HS, Duh YC. Perforated Meckel's diverticulum in a neonate.JFormos MedAssoc.1996;95:644Y645.
16. Gandy J, Byrne P, Iees G. Neonatal Meckel's diverticulum inflammation withperforation.J PediatrSurg.1997;32:750Y752.
17. KumarP,OjhaP, SinghUK. Spontaneousperforation ofMeckel'sdiverticuluminaneonate.IndianPediatr.1998;35:906Y908.
18. Zahraa J, Abu-Ekeish F, Al Bassam AR, et al. Perforated Meckel's diverticulum in aneonatemimickingnecrotizingenterocolitis.PediatrEmergCare.2003;19:418Y419.
19. Sy ED, Shan YS, Yang YR, et al. Hirschsprung's disease, a rare precipitating factor inneonatalperforatedMeckel'sdiverticulum.JPediatr Surg.2006;41:1319Y1321.
20. ChangJT,LinJY,HuangYS.SpontaneousperforationofMeckel'sdiverticulumwithoutperito nitisinanewborn:reportofacase.Surg Today. 2006;36:1114Y1117.
21. Oyachi N, Takano K, Hasuda N, et al. Perforation of Meckel's diverticulum manifestingasasepticperitonitisinaneonate: reportofacase.Surg Today.2007;37:881Y883.
22. Aguayo P, Fraser JD, St Peter SD, et al. Perforated Meckel's diverticulum in amicroprematureinfantandareviewofliterature.PediatrSurg Int.2009;25:539Y541.
23. AlkanM,Gu¨lerG,YildirimF,etal.PerforationofaninflamedMeckel'sdiverticuluminanewborn:reporto fa case.TurkJGastroenterol.2009;20:235Y236.
24. Khan A, de Waal K. Pneumoperitoneum in a micropremie: Not always NEC. Case RepPediatr2012;2012:295657.
25. Bertozzi M, Melissa B, Radicioni M, Magrini E, Appignani A. Symptomatic Meckel'sdiverticulum in newborn: two interesting additional cases and review of literature. PediatrEmergCare.2013Sep;29(9):1002-5.doi:10.1097/PEC.0b013e3182a315e5.PMID:24201981.
26. Stanley Cranksona ,AbdulhafidhKadhia , Khalil Al Tawilb and Ibrahim A. AhmedMeckel's diverticulum: a rare cause of intestinal perforation in a preterm newborn Annals ofPediatricSurgery2013,9:147-149
27. Smolkin T, Hayari L, Zohar Y, Steinberg R, Makhoul IR. Meckel diverticulum in aprematureinfant:Tootinybutstillperforates.JPediatr2013;162:1075.e1.
28. Borgi A, Bouziri A, Boujelbene N, Sghairoun N, Belhadj S, Benjeballah N. PerforatedMeckel's diverticulum in a very preterm baby revealed at birth. Fetal PediatrPathol. 2014Apr;33(2):119-22. doi: 10.3109/15513815.2013.850133. Epub 2013 Dec 13. PMID:24328940
29. Alvares BR, Yumioka AS, Dos Santos GG. Uncommon presentation of perforatedMeckel's diverticulum in preterm newborn. Radiol Bras. 2015 Jul-Aug;48(4):265-6. doi:10.1590/0100-3984.2014.0134. PMID:26379328;PMCID: PMC4567368.
30. OrelaruF.O.a, b,ReddyN.S.b,BrahmamdamP.a, b Perforated Meckel's diverticulum in

aneonate,JournalofPediatric Surgery CaseReports37,pp.37-40
31. Wang YJ, Wang T, Xia SL, Zhang YC, Chen WB, Li B. Perforation of Meckel`s diverticulumin a very low birth weight neonate with severe pneumoperitoneum and review of literature.TurkJPediatr.2019;61(3):460-465.doi:10.24953/turkjped.2019.03.025.PMID: 31916731.
32. McKelvie M, Soares-Oliveira M, Wang-Koh Y, Trayers C, Aslam A. Beware the InnocentPresentation of a Spontaneous Perforated Meckel Diverticulum: A Rare Case and Review ofthe Literature. PediatrEmerg Care. 2019 Dec;35(12):881-883. doi:10.1097/PEC.0000000000001993.PMID:31790074
33. Charki MT, AbdellaouiH,AndaloussiS, OukhouyaMA,MahmoudiA, ElMadiA,KhattalaK, Bouabdallah Y. Congenital fistulisation of Meckel's diverticulum in omphalocele sac: casereport. Pan Afr Med J. 2019 Jan 15;32:20. doi: 10.11604/pamj.2019.32.20.15010. PMID:31143325;PMCID:PMC6522166.
34. Bindi E, Cruccetti A, Ilari M, Mariscoli F, Carnielli VP, Simonini A, Cobellis G. Meckel'sdiverticulum perforation in a newborn positive to Sars-Cov-2. J PediatrSurg Case Rep. 2020Nov;62:101641. doi: 10.1016/j.epsc.2020.101641. Epub 2020 Aug 29. PMID: 32904556; PMCID:PMC7456189.
35. Urrutia Soto H, Donoso Carrasco C, Carvajal Flores O. Symptomatic Meckel'sDiverticulum in pediatrics. Andes Pediatr. 2021 Feb;92(1):104-109. English, Spanish. doi:10.32641/andespediatr.v92i1.2470.Epub 2021Feb 22. PMID:34106190.
36. SolteroMJ, BillAH. ThenaturalhistoryofMeckel'sdiverticulumanditsrelationtoincidentalremoval. AmJ Surg.1976;132:168Y171.
37. Moore KL, Persaud TVM. The Developing Human. Clinically Oriented Embryology.Philadelphia,PA:W.B.SaundersCompany;1993:255Y256.
38. Y. Ding, Y. Zhou, Zh Ji, et al.Laparoscopic management of perforated Meckel'sdiverticuluminadultsIntJ MedSci,9(3)(2012),pp.243-247
39. Snyder CL. Meckel's diverticulum. In: Grosfeld JL, O'Neill JA Jr,Fonkalsrud EW, Coran AG,eds. PediatricSurgery.Vol2.6thed.Philadelphia, PA:MosbyElsevier;2006:1304Y1312.
40. Meguid M, Canty T, Eraklis AJ. Complications of Meckel's diverticulum in infants. SurgGynecol Obstet.1974;139:541Y544.