Case Report

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.109397
Quick Response Code:

Is hypertrophic pyloric stenosis a secondary disease?

Fariba Tabrizian Namini, Seyed Mohammad Ali Raisolsadat[1], Fateme Omid, Mostafa Mirzade

ABSTRACT

Hypertrophic pyloric stenosis (HPS) is the most common gastrointestinal obstructive disease in infants which requires surgery. Typical presentation is at 4-6 weeks of life but can present very earlier or congenitally. Here we present 3 cases of HPS which presented in the first day of life with co-existing malrotation, annular pancreas, and duodenal atresia. The exact etiology of HPS is not fully understood, however, genetic and maternal factors, hormonal factors, abnormalities of various components of the pyloric muscle, growth factors, extracellular matrix elements, nerve and ganglion cells synapses, nerve supporting cells, neurotransmitters and interstitial cells, drugs, and feeding have been implicated. In the HPS concomitant with a distal obstruction, mean that these obstructions may role in pathogenesis of HPS or may exacerbate other factors to produce HPS in a very early age or congenitally. The purpose of this manuscript is to present three cases of HPS in the first day of life with other GI anomalies. We hypothesize that the etiology of some cases of HPS may be secondary to distal intestinal obstructions especially when it presents very early in life, or at least to concern a distal obstructions in this very early presentation.

Key words: Etiology, GI anomaly, hypertrophic pyloric stenosis

INTRODUCTION

Hypertrophic pyloric stenosis (HPS) is the most common obstructive disease in requiring surgery in infants. It presents with non-bilious projectile vomiting typically around 3–4 weeks of age and usually leads to electrolyte and acid - base imbalance.[1,2] It is estimated to occur in about 1 in 400-600 births, with a distinct male predominance of about 6 - 4:1[3] with firstborn males more likely to be affected than their siblings. HPS is relatively uncommon in black or Asian infants. There is also a strong genetic component, particularly through the maternal line[4] but, the etiology remains unclear.[5,6]

Although HPS is common in the neonatal period, it is uncommon in the first week of life and unlikely to be present with other GI anomalies. Here, we present three rare cases of HPS with other concurrent obstructive GI anomalies in the first week of life. We hypothesize that the development of HPS in patients with concurrent distal intestinal obstruction may be a secondary effect due to prenatal forceful contractions of pyloric canal muscle against the obstruction.

CASE REPORTS

Case 1

A one day old full term male presented with non-bilious vomiting. His mother had not taken any drug or medications during pregnancy. On physical examination, the features were consistent with Down's syndrome, abdominal distention, and dehydration. His lab findings were, *p*H =7.56, Cl = 70 meq/L, Na = 130 mg/dL and K = 3.2 mg/dL. On abdominal sonography he had a 28 mm long and 4 mm thick pyloric canal. Patient subsequently underwent laparotomy for open pyloromyotomy. Intraoperative findings included an annular pancreas in addition to HPS. Pyloromyotomy and duodenoduodenostomy was performed. Patient was discharged home on post-operative day (POD) 5, and is doing well on 7 month follow-up.

Case 2

A one-day old full term girl, born by cesarean section was admitted to the neonatal intensive care unit (NICU) with grunting, cyanosis, reduced reflexes, vomiting and icterus. Abdominal examination revealed a distended upper abdomen. She did not have any phenotypically markers of HPS such as hypoplasia or agenesis of inferior labial frenulum or a family history. She was

Department of General Pediatric, [1]General Pediatric Surgery, 22 Bahman Hospital, Islamic Azad University of Mashhad, Iran

Address for correspondence:
Dr. Raisolsadat Seyed Mohammad Ali,
Department of General Pediatric Surgery, 22 Bahman Hospital,
Islamic Azad University of Mashhad, Iran.
E-mail: Raisolsadat.mohammad@childrens.harvard.edu

treated for presumed sepsis but her periodic bilious and non-bilious vomiting continued for two days. A plain abdominal X-ray revealed a distended stomach [Figure 1] and ultrasonography demonstrated a pyloric canal length of 25 mm and pyloric muscle thickness of 3.5 mm, consistent with the diagnosis of HPS. She underwent laparotomy for pyloromyotomy, during which Ladd's Bands and a malrotation without atresia or short bowel were also identified. A Ladd's procedure and Fredet- Ramshted ploromyotomy was performed. Oral feeding was started on POD 2 and patient was discharged home on POD 5. At the 18 month follow up, the patient is doing well well and developing normally.

Case 3

A One day old male, born via vaginal delivery to a 23 year old G1P1 developed non-bilious projectile vomiting soon after starting breast-feeding. Upon presentation, the abdomen was not distended and the general physical examination was unremarkable. Routine blood work did not demonstrate anemia, hyperbilirubinemia or thyroid dysfunction or other anomalies. He was transferred to the NICU and a nasogastric tube was inserted for irrigation with normal saline that demonstrated bilious reflux. The abdominal contrast film demonstrated a double bubble sign. At laparotomy, HPS was noted in addition to duodenal atresia as a web type (type I). Duodenal web resection was performed through the pylorotomy and was followed by pyloroplasty and omental patch placement. The patient had an uneventful recovery and was discharged home on POD 5.

DISCUSSION

Infantile hypertrophic pyloric stenosis (IHPS) is the most common inherited form of gastrointestinal obstruction in infancy with an incidence of 1-8 per 1000 live birth. It is inherited as a complex sex-modified multifactorial trait with a striking male preponderance.[3,7,8] Affected infants most commonly present at 2-3 weeks of life but can uncommonly present earlier or congenitally. There are a few reports of HPS that have occurred in the first week of life which it was against of acquired appearing condition.[9-13] Despite numerous hypotheses, the aetiopathogenesis of IHPS is not fully understood. Genetic analysis has implicated loci on chromosomes 11q and Xq.p.[8] Maternal factors that contribute to the risk of development of IHPS in the off springs of affected females were but in contrast to several earlier reports, analysis does not support this co-existence.[14] Extrinsic and hormonal factors have been implicated in the pathogenesis of the disease, the disease 5 times more common in male than female infants. It has been hypothesized that the higher risk among male infants is associated with high levels of testosterone causing hypertrophy of the pylorus muscle,[15] but it not proved. Lower Plasma nitrite levels may also play a role in IHPS.[16] Furthermore, abnormalities of various components of the pyloric muscle such as smooth muscle cells,[17,18] growth factors,[19,20] extracellular matrix elements, and nerve and ganglion cells considered.[21] Okazaki *et al.*, used monoclonal antibody targeted to nerve terminals and found a reduced density of both neural elements,[22] synapses, nerve supporting cells,[23] neurotransmitters and interstitial cells of Cajal have been reported in patients with IHPS.[24,25] The significant increase in pyloric stenosis in children with very early exposure to erythromycin has also been implicated.[26-28] In addition, an association between maternal use of fluoxetine and infantile hypertrophic pyloric stenosis (IHPS) was of particular interest.[29] also respiratory viral infections implicated but not proved[30] In a study by, Persson S. *et al.*,[31] environmental factors have been implicated since a period of postnatal enteral feeding is required for the disease to develop. In contrast our cases were symptomatic earlier than the period needed to effect environmental factors and feeding and they had not any drug consumption. All of the above factors may be responsible but a few of them has completely proved, this is the first reason to introduce our hypothesis, on the other hand we could find very few paper about HPS and malrotation or duodenal atresia concomitantly in our Medline search, that is our second reason to report these cases. It has been reported that, HPS can be associated with other malformations such as esophageal atresia, diaphragmatic hernia, and malrotation.[32-34] Patients with HPS and malrotation had congenital short bowel and dysmotility in familial cases,[35] however, our case did not have dysmotility or



Figure 1: A plain abdominal X-ray revealed a distended stomach

short bowel. Here we present HPS accompanied with duodenal atresia, web type (type I). In a study by Kao *et al.*, they report duodenal web with HPS in Down's syndrome.[36] One of our presented cases (HPS + annular pancreas) also had Down's syndrome. Also we did not find any reports that mentioned an obstruction distal to pylorus may need forceful peristaltic waves in pre-natal period. Only in an experimental animal model of the disease, pyloric stenosis may be considered as an inborn pathology as a consequence development of working hypertrophy.[37] In our cases presented here, the co-existence of annular pancreas, malrotation, duodenal web, and atresia caused obstructions which resulted in forceful muscle contractions of the pyloric channel. We hypothesize that these forceful contractions may be the primary etiology for the development of early HPS as well as exacerbating the symptoms of congenital HPS.

CONCLUSION

Here we presented very rare cases of HPS in conjunction with malrotation, duodenal atresia, and annular pancreas. In these cases, the presence distal obstructions to the HPS resulting in early presentation, we therefore, hypothesized that in these cases, HPS may be a secondary disease resulting from forceful contractions of the pyloric muscles against a distal obstruction, and concern distal obstruction when HPS present very early.

ACKNOWLEDGMENT

The authors acknowledge with great thanks of Dr. Khashayar Vakili Pediatric surgeon at Boston Children's Hospital (Harvard medical school) for careful writing correction of this manuscript.

REFERENCES

1. Ohshiro K, Puri P. Pathogenesis of infantile hypertrophic pyloric stenosis: Recent progress. Pediatr Surg Int 1998;13:243-52.
2. Marshall Z. Schwartz. Hypertrophic pyloric stenosis. In: Grosfeld JL, O'Neill JA, Fonkalsrud EW, Coran AG, editors. Pediatric Surgery. 6th ed, Vol 2. Mosby; 2006; p. 1215.
3. Saula PW, Hadley GP. Hypertrophic pyloric stenosis in the Third World 2. Trop Doct 2011;41:204-10.
4. Svenningsson A, Lagerstedt K, Omrani MD, Nordenskjöld A. Absence of motilin gene mutations in infantile hypertrophic pyloric stenosis. J Pediatr Surg 2008;43:443-6.
5. Langer JC, Daniel EE. Hypertrophic pyloric stenosis: Ultra-structural abnormalities of enteric nerves and interstitial cells of Cajal. J Pediatr Surg 1995;30:1530-43.
6. Ozsvath RR, Poutschi-Amin M, Leonidas JC, Elkowitz SS. Pyloric volume: An important Factor in the surgeon's ability to palpate the pyloric "olive" in hypertrophic pyloric stenosis. Pediatr Radiol 1997;27:175-7.
7. Safford SD, Pietrobon R, Safford KM, Martins H, Skinner MA. Rice HE A study of 11,003 patients with hypertrophic pyloric stenosis and the association between surgeon and hospital volume and outcomes. J Pediatr Surg 2005;40:967-73.
8. Everett KV, Chioza BA, Georgoula C, Reece A, Capon F, Parker KA, *et al*. Genome-wide high-density SNP-based linkage analysis of infantile hypertrophic pyloric stenosis identifies loci on chromosomes 11q14-q22 and Xq23. Am J Hum Genet 2008;82:756-62.
9. Leaphart CL, Borland K, Kane TD, David J. Hypertrophic pyloric stenosis in newborns younger than 21 days: Remodeling the path of surgical intervention. J Pediatr Surg 2008;43:998-1001.
10. Ali KI, Haddad MJ. Early infantile hypertrophic pyloric stenosis: Surgery at 26 hours of age. Eur J Pediatr Surg 1996;6:233-4.
11. Geer LL, Gaisie G, Mandel VS, Scatliff H, Thullen JD. Evolution of pyloric stenosis in the first week. Pediatr Radiol 1985;15:205-6.
12. Tandoh JF, Hesse AA. Infantile hypertrophic pyloric stenosis in Ghana. West Afr J Med 1992;11:135-9.
13. Andrassy RJ, Haff RC, Larsen GL. Infantile hypertrophic pyloric stenosis during the first week of life. Approaches to diagnosis, based on observations of a newborn whose vomiting began on the first day. Clin Pediatr (Phila) 1977;16:475-6.
14. Mitchell LE, Risch N. The genetics of infantile hypertrophic pyloric stenosis. A reanalysis. Am J Dis Child 1993;147:1203-11.
15. Krogh C, Cohen AS, Basit S, Hougaard DM, Biggar RJ, Wohlfahrt J, *et al*. Testosterone levels in umbilical-cord blosod and risk of pyloric stenosis. Pediatrics 2011;127:e197-201.
16. Huang LT, Tiao MM, Lee SY, Hsieh CS, Lin JW. Low plasma nitrite in infantile hypertrophic pyloric stenosis patients. Dig Dis Sci 2006;51:869-72.
17. Subramaniam R, Doig CM, Moore L. Nitric oxide synthase is absent in only a subset of cases of pyloric stenosis. J Pediatr Surg 2001;36:616-9.
18. Takahashi T. Pathophysiological significance of neuronal nitric oxide synthase in gastrointestinal tract. J Gastroenterol 2003;38:421-30.
19. Spitz L, Zail SS. Serum gastrin levels in congenital hypertrophic pyloric stenosis. J Pediatr Surg 1976;11:33-5.
20. Cristoffides ND, Mallet E, Ghatei MA, Lee Y, Bloom SR. Plasma entroglucagonand neurotensin in infantile pyloric stenosis. Arch Dis Child 1983;58:52-5.
21. Friesen SR, Boley JO, Miller DR. The myenteric plexus of the pylorus: It's early normal development and its changes in hypertrophic pyloric stenosis. Surgery 1956;39:21-9.
22. Okazaki T, Yamakata A, Fujiwara T, Nishiye H, Fujimoto T, Miyano T. Abnormal distribution of nerve terminals in infantile hypertrophic pyloric stenosis. J Pediatr Surg 1994;29:655-8.
23. Kobayashi H, O'Briain DS, Puri P. Selective reduction of intramuscular nerve supporting cells in infantile hypertrophic pyloric stenosis. J Pediatr Surg 1994;29:651-4
24. Piotrowska AP, Solari V, Puri P. Distributionof heme oxygenase-2 in nerve s and interstitial cells of Cajal in the normal and in infantile hypertrophic pyloric stenosis. Arch Pathol Lab Med 2003;127:1182-6.
25. Panteli C. New insights into the pathogenesis of infantile pyloric stenosis. Pediatr Surg Int 2009;25:1043-52.
26. Shoji H, Suganuma H, Daigo M, Shinohara K, Umezaki H, Shiga S, *et al*. Hypertrophic pyloric stenosis in mono-ovular extremely preterm twins after use of erythromycin. Pediatr Int 2008;50:701-2.
27. Cooper WO, Griffin MR, Arbogast P, Hickson GB, Gautam S, Ray WA. Very early exposure to erythromycin and infantile hypertrophic pyloric stenosis. Arch Pediatr Adolesc Med 2002;156: 647-50.
28. Oliva Rodríguez-Pastor S, García Martín FJ, Milano Manso G. Erythromycin and hypertrophic stenosis of the pylorus. An Esp Pediatr 2001;54:318.
29. Bakker MK, De Walle HE, Wilffert B, de Jong-Van den Berg LT. Fluoxetine and infantile hypertrophic pylorus stenosis: A signal from a birth defects-drug exposure surveillance study. Pharmacoepidemiol Drug Saf 2010;19:808-13.
30. Mcheik JN, Dichamp I, Levard G, Ragot S, Beby-Defaux A, Grosos C, *et al*. Infantile hypertrophic pyloric stenosis: Are viruses involved?

J Med Virol 2010;82:2087-91.
31. Persson S, Ekbom A, Granath F, Nordenskjold A. Parallel incidences of sudden infant death syndrome and infantile hypertrophic pyloric stenosis: A common cause? Pediatrics 2001;108:E70.
32. Iijima T, Okamatsu T, Matsumaura M, Yatsuzuka M. Hypertrophy pyloric stenosis associated with hiatus hernia. J Pediatr Surg 1996;31:277-9.
33. Magilner AD. Esophageal atresia and hypertrophic pyloric stenosis. AJR Am J Roentgenol 1986;147:329-30.
34. Laugier J, Mrcier C, Robert M, Casenave C. Syndrome of a shortened small intestine with Malrotation and hypertrophic pyloric stenosis. Arch Fr Pediatr 1975;32:593.
35. Nezelof C, Jaubert F, Lyon G. Familial syndrome combining short small intestine, intestinal malformation, pyloric hypertrophy and brain malformation: 3 anatomoclinical case. Ann Anat Pathol (Paris) 1976;21:401-12.
36. Kao SC, Muir LV, Kimura K. Combined hypertrophic pyloric stenosis and duodenal web in Down syndrome: Sonographic and radiographic diagnosis. J Ultrasound Med 1996;15:475-7.
37. Simonishvili A, Bagaturia. The etiology and pathogenesis of infantile pyloric stenosis. Georgian Med News 2005;126:41-4.

Cite this article as: Namini FT, Raisolsadat SA, Omid F, Mirzade M. Is hypertrophic pyloric stenosis a secondary disease?. Afr J Paediatr Surg 2013;10:46-9.

Source of Support: Nil. **Conflict of Interest:** No.