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Pyloric Stenosis of Infancy and Primary Hyperacidity. A Global Perspective

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Abstract

Primary hyperacidity is proposed as a cause of pyloric stenosis of infancy. All the curious clinical features of this enigmatic condition are satisfactorily explained by the primary hyperacidity theory including the first-born tendency; the tendency to self-cure; the male predominance and the time sensitive presentation.

It is proposed that the mechanisms of early developmental hyperacidity, which reduces early enteric infections, facilitates the development of pyloric stenosis in the constitutionally hyperacid baby. The incidence of this condition may thus be maintained by the pressures of natural selection which favours the maintenance of an acid barrier.

A plea is made for the use of H2 receptor antagonists or proton pump inhibitors when surgical help is unavailable,

Conclusion: This theory fits the need to explain the clinical characteristics. It has practical application especially in the third world. No other theories are sufficiently consistent with the clinical features.

Keywords: *Pyloric Stenosis of Infancy; Developmental Neonatal Hyperacidity; Global Medicine; Etiology*

Abbreviations

PS: Pyloric Stenosis of Infancy.

"To put your mind into accordance with things as they really are- "after James Clerk Maxwell in a letter of encouragement to a fellow Physicist (circa 1850).

PS of infancy is the most-common cause of upper gastro-intestinal obstruction in the neonatal period. It affects human babies and the young of many other mammals. The incidence in human babies is around 2-5 in every 1000 babies. The cause remains unknown.

The baby typically displays persistent projectile vomiting of milk feeds around 3 weeks of age. Mortality if untreated is well over 50% and was a staggering 75% in the early days of hospital based surgery [1]. The present surgical treatment of sphincter division produces a long-term cure with almost no mortality.

At operation or at post-mortem there is a swelling of the pyloric sphincter known as a pyloric tumour which prevents the stomach emptying. The tumour is caused by hypertrophy of the sphincter muscle fibres [2]. There is no tumour at birth [3].

Clinical Clues which point to the cause

It is an adage oft repeated-and certainly true. Listen to the patient-he is telling you the diagnosis. So, must it be with the cause pyloric stenosis of infancy (PS).

The infant is certainly very generous with his clues. -the babies typically present at 3 weeks of age-and there is a natural cure with time or with temporary medical treatment if the baby survives for long enough. There is a 5/1 male predominance with a strong familial

tendency and the baby classically displays an eagerness to feed. The tumour completely disappears when the sphincter is divided yet persists after gastroenterostomy despite the baby otherwise progressing well [4]. Even more curiously, the condition is more common in first born babies.

The Primary Hyperacidity theory of cause is the only one which can satisfactorily explain all these clinical features.

In the beginning, repeated pylorospasm with work hypertrophy was the favored explanation. Indeed, Freund in 1903 declared that a hydrochloric acid content in excess of normal was the cause of repeated pylorospasm and thus the cause of sphincter work hypertrophy [5]. This theory silently lapsed presumably for want of corroborative data.

John Thomson in 1921 [1] in a perceptive analysis of cause, debates the two main theories. I quote-

> ***"Is the abnormal action of the pylorus a secondary phenomenon, due to the muscular coat being primarily affected by a simple congenital redundancy of growth as Hirschsprung and others have suggested? Or is the functional abnormality to be regarded as the primary element in the process- the muscle being hypertrophied merely because- from an early period it has been worried into overgrowth by constantly recurring overaction"***

Recent studies have finally revealed that

1. PS babies do hyper secrete acid. This hyperacidity persists after the obstruction is relieved [6-7].

2. Babies who repeatedly vomit in the neonatal period and who become alkalotic invariably have PS. The implication is that PS babies are producing and losing more acid than babies who vomit for other reasons [8].

3. The most potent stimulus to sphincter contraction (in adults) is the entry of acid into the duodenum [9-11].

4. New-born puppy dogs develop PS indistinguishable from human PS when pentagastrin injections are given to their mothers before birth. Even more puppies develop PS when they also receive injections [12]. Some of these puppies had superficial ulceration of the duodenum pointing to gastric-induced hyperacidity as the cause. Pentagastrin is the active part of gastrin- the hormone which causes gastric acid secretion and which crosses the mammalian placenta and causes foetal gastric acid secretion in dogs [13].

5. Sphincter division (pyloro-myotomy) quickly causes the tumour to disappear. Gastro-enterostomy does not. Hence a functioning sphincter is integral to the formation of the tumour and work-hypertrophy is the obvious explanation.

6. Sphincter contraction in adults is most vigorous and frequent after a feed when the stomach peristalses against a repeatedly closing pylorus. By this means good mixing of the food occurs [14].

7. Survivors of PS frequently develop hyperacidity problems in adult life [15].

8. The 5/1 male sex preponderance exactly parallels the male sex preponderance in adult duodenal ulcer- a condition known to be caused by hyperacidity and a well-preserved appetite. Pre-term normal male infants have also been shown to secrete more acid than matched female infants [16].

9. Duodenal ulcer patients and babies with PS share the same preponderance of the O blood group. This is associated with hyperacidity especially with a non-secretor status [17-18].

10. H2 receptor blockers when used pre-operatively in PS babies rapidly restore the acid-base status and allow safe surgery within 24 hours [19]. Indeed, this treatment alone produces a long-lasting cure in 16/17 cases when the tumour is less than 4 mm. in diameter [20].

Consequently, a pathogenesis based on the inheritance of constitutional hyperacidity, repeated sphincter contraction and work hypertrophy appears to be well founded. Indeed, the evidence is overwhelming.

There is however a missing link. Why is the presentation delayed until 3 weeks after birth and why do surviving babies have a long-lasting self-cure.

These observations strongly suggest a temporary time-sensitive developmental process. Such a process has recently been accidentally discovered.

The Missing Link

Soon after birth all babies develop steeply rising levels of fasting gastrin which are significantly higher than in adults [21]. Furthermore, these levels are not increased by feeding and it is presumed that they are already being maximally stimulated [22].

At a later time, fasting gastrin levels revert to an adult pattern with lower fasting gastrin and a measurable post-feed increase. The authors of this report suggest that gastrin in the first few weeks is relatively insensitive to the normal negative feed-back between gastrin and antral acidity [22-23]. The baby during this early time may be considered to suffer from a physiological temporary Zollinger-Ellison syndrome.

Normal service is resumed around 3 months when the adult negative feed-back is established- fasting gastrins fall and a post-feed response is detected [24].

If this is true, then we would expect all babies to display gastrin-induced peak acidity just at the time when the negative feed –back is becoming established.

Agunod has demonstrated just such peak acidity in normal development at around 17 days of life [25].

This natural phenomenon means that the baby who inherits constitutional hyperacidity will become dangerously hyperacid at around 17 days with the potential to develop a work-hypertrophied obstructing pyloric tumour. Should the baby survive alkalosis, dehydration and mineral depletion, the falling acidity and the widening of the pylorus with time, may combine to allow a natural self-cure.

This process by which significant gastric acidity in the neonate is maintained will be an effective antidote to early enteric infections and may have evolved by the pressures of natural selection. The development of PS in already hyperacid babies may be one of the few disadvantages.

This mechanism requires no unnatural explanations. Work hypertrophy of the sphincter is entirely possible through the agencies of the normal basic physiology of the stomach. Repeated sphincter contraction under the influence of the acid secretory and trophic effects of a rising gastrin is all that is required. There is no need to go beyond.

This theory is consistent with the known increase in PS when babies receive erythromycin- a drug known to increase contractility of the stomach and pylorus [26-27].

The increased incidence of PS in trachea-oesophageal fistula may simply occur because of the absence of the alkalinizing effect of amniotic fluid in the stomach. These babies are born with hyperacidity which is not constitutional but environmental [28]. They have in a sense-a head start.

Inappropriate repeated feeding of the vomiting baby at physiological peak acidity - may well tip the balance to a full-blown PS by adding frequent food related sphincter contractions to the acid effect. It is suggested that the anxious first-time mother is more likely to do this.

The original comprehensive clinical description of PS by John Thompson in 1921 recognized "the not uncommon" mild cases of PS which may quickly resolve naturally - (providing that they are not overfed!) [1,29].

Clearly genetics must have a part to play. This may simply be a role in which hyperacidity is inherited or facilitated due to a combination of genetic factors. A multifactorial inheritance of PS is the acceptable consensus view at this time.

The Global Perspective

The diagnosis of PS ought to be an easy. Projectile vomiting of milk feeds in a hungry (usually male) baby in the first few weeks of life should be enough. Yet there are repeated and frequent instances of missed and late diagnosis of PS in the Western world. Hence the reported infrequency of PS in undeveloped countries may not be real.

Access to paediatric anesthetists and surgeons is rarely available in these countries.

Non-surgical methods with limited feeds, fluid balance care and the timely use of anti-acid measures such as H2 receptors or proton-pump inhibitors have potential to help in these circumstances. These drugs not only quickly address the associated alkalosis but will also reduce the volume of fluid and electrolyte loss and may provide sufficient time for this condition to spontaneously improve. It should also gain time to allow referral to an available hospital.

The more traditional form of medical treatment included the use of atropine as an anti-spasmodic. The effect of atropine in relaxing the infant pylorus has never been put to the test. However, by the anti-cholinergic effect it will reduce the vagal contribution to both acid secretion and gastric muscular activity.

The consequences however of a poorly controlled dosage –either too little or too much, may be serious and life threatening. Dangerous tachycardias, a feature of over dosage-are well documented [29].

H2 receptors and Proton Pump inhibitors have no such negative effects and are used safely in this age group. Indeed, in established cases of adult pyloric stenosis from duodenal ulcer they may also, used alone, produce a cure [30].

It is proposed that pre-operatively H2 receptor antagonists or PPI drugs should be used to make surgery safer without waiting too long.

It is also proposed that the persistently milk-vomiting neonate be treated by H2 receptor antagonists or PPI in preference to atropine when paediatric specialized help is not available.

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Conflict of Interest

There has been no specific funding.

A more comprehensive account of the supporting evidence for this theory will be obtained in: The Consequences and Cause of Pyloric Stenosis of Infancy. Two Personal Stories.

Dr. Fred. Vanderbom and Ian Munro Rogers. More Books(Lambert Academic Publishing) ISBN 978-3-65952125-6.

Bibliography

1. Thomson J. "Observations on congenital hypertrophy of the pylorus". *Edinburgh Medical Journal* 26 (1921): 1-20.

2. Oue T and Puri P. "Smooth muscle hypertrophy versus hyperplasia in IHPS". *Pediatric Research* 45.6 (1999): 853-857

3. Wallgren A. "Incidence of IHPS". *American Journal of Diseases of Children* 62 (1941): 751.

4. Dickinson SJ and Brant EE. "Congenital pyloric stenosis: Roentgen findings 52 years after gastroenterostomy". *Surgery* 62.6 (1967): 1092-1094.

5. Freund W. Central.bl.f.d.Grenzgib.d.Med.u.Clin 11 (1903): 309.

6. Rogers IM., *et al*. "Serum cholecystokinin, basal acid secretion and infantile hypertrophic pyloric stenosis". *Archives of Disease in Childhood* 54.10 (1979): 773-775.

7. Heine W., *et al*. "Results of Lambling gastric juice analysis (histamine stimulation) in infants with spastic hypertrophic pyloric stenosis". *Padiatrie und Padologie* 21 (1986): 119-125.

8. Maizels M. "Alkalosis in the vomiting of infancy". *Archives of Disease in Childhood* 6.35 (1931): 293-302.

9. Cook AR. "Duodenal acidification: Role of the first part of the duodenum in gastric emptying and secretion in dogs". *Gastroenterology* 67.1 (1974): 85-92.

10. Fisher RS., *et al*. "The hormonal regulation of the pyloric sphincter function". *Journal of Clinical Investigation* 52.5 (1973): 1289-1296.

11. Hunt JN and Ramsbottom N. "Effect of gastrin 11 on gastric emptying and secretion during a test meal". *British Medical Journal* 4 (1967): 386-390.

12. Dodge JA and Karim AA. "Induction of pyloric hypertrophy by pentagastrin". *Gut* 17.4 (1976): 280-284.

13. Bruckner WL., *et al*. "Gastric secretion in the canine foetus following maternal stimulation: Experimental studies on placental transfer of insulin, histamine and gastrin". *Surgery* 67.2 (1970): 360-363.

14. Ehrlein H J and Schemann M. "Gastrointestinal motility". 19-26.

15. Wanscher B and Jensen HE. "Late follow-up studies after operation for congenital pyloric stenosis". *Scandinavian Journal of Gastroenterology* 6.7 (1971): 597-599.

16. Ames Mary. "Gastric acidity in the first 10 days of life of the prematurely bornbaby". *American Journal of Diseases of Children* 2 (1959): 1123-1126.

17. Koster KH., *et al*. "ABO blood groups and gastric acidity". *The Lancet* (1955).

18. Dodge JA. "ABO blood groups and IHPS". *British Medical Journal* 4.5582 (1967): 781-782.

19. Banieghbal B. "Rapid correction of metabolic alkalosis in hypertrophic pyloric stenosis with intravenous cimetidine: preliminary results". *Pediatric Surgery International* 25.3 (2009): 269-271.

20. Banieghbal. "Personal communication" (2013).

21. Rogers IM., *et al*. "Neonatal secretion of gastrin and glucagon". *Archives of Disease in Childhood* 49.10 (1974): 796-801.

22. Rodgers BM., *et al*. "Fasting and postprandial serum gastrin in normal human neonates". *Journal of Pediatric Surgery* 13.1 (1978): 13-16.

23. Moazam F., *et al*. "Physiology of serum gastrin production in neonates and infants". *Annals of Surgery* (1984): 389-392.

24. Waldum HI., *et al*. "Hypergastrinaemia in animals and man: causes and consequences". *Scandinavian Journal of Gastroenterology* 39.6 (2004): 505-509.

25. Agunod M. "Correlative study of hydrochloric acid, pepsin and intrinsic factor secretion in newborns and infants". *American Journal of Digestive Disease* 14.6 (1969): 400-413.

26. Honein MA., *et al*. "Infantile pyloric stenosis after pertussis prophylaxis with erythromycin: A case review and cohort study". *Lancet* 354.9196 (1999): 2101-2105.

27. SanFilippo A. "Infantile hypertrophic pyloric stenosis related to the ingestion of erythromycin estolate: A report of five cases". *Journal of Pediatric Surgery* 11.2 (1976): 177-180.

28. Vilarino A., *et al*. "Association of oesophageal atresia and hypertrophy of pyloric stenosis". *Cirugía Española* 31 (1977): 239-241.

29. Jacoby NM. "Pyloric stenosis: Selective medical and surgical treatment". *Lancet* 1.7221 (1962): 119-121.

30. Talbot D. "Treatment of adult pyloric stenosis: a pharmacological alternative?". *British Journal of Clinical Practice* 47.4 (1993): 220-221.

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