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Review Article

Darwin, Primary Hyperacidity and Pyloric Stenosis-Some Thoughts

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Abstract

A review is given of the mechanisms which provide an effective gastric acid barrier to enteric infections in the first few weeks of life. Gastrin transfer from mother to baby at the time of labour initiates an early wave of gastric acidity to counteract the early alkalinising effect of swallowed liquor. A rising functional neonatal gastrin secretion (initially unrestrained by a negative feed-back with gastric acidity) maintains gastric hyperacidity, sufficient to keep the neonate safe from enteric infections in the first few weeks of life.

The baby born with a parietal cell mass above average-the baby with constitutional hyperacidity-is not immune from these mechanisms. Repeated pyloric sphincter contractions in response to duodenal hyperacidity will produce pyloric sphincter work hypertrophy and pyloric stenosis.

Darwin's theory of natural selection predicts that any genetic constitution which threatens survival to a reproductive age, would gradually disappear with time.

Constitutional hyperacidity leading to pyloric stenosis over the last 100 years has shown no sign of disappearing. It is argued that the greater effectiveness of hyperacidity in repelling enteric neonatal infections and the widespread use of almost mortality- free pyloromyotomy, both combine to ensure that this genetic inheritance survives.

Keywords: *Darwin; Hyperacidity; Pyloric Stenosis*

Abbreviation

PS : Pyloric Stenosis of Infancy

Introduction

Many dangers await the newly born baby. One of them is enteric infections [1]. The recently delivered baby has usually swallowed liquor; the stomach is alkaline and the acid barrier to enteric infections at that time does not exist. Nature, presumably by evolutionary mechanisms, has devised a protective developmental system in which acid secretion is boosted and maintained in the first few weeks of life. This article analyses these processes in the light of the known hyperacidity associated with pyloric stenosis of infancy.

In 1941 Miller showed that a wave of neonatal hyperacidity occurred some hours after birth and lasted several days [2] (Figure 1). He thought correctly that a chemical was transferred from mother to baby at the time of labour to cause a temporary wave of hyperacidity. That chemical was the still to be discovered hormone called gastrin.

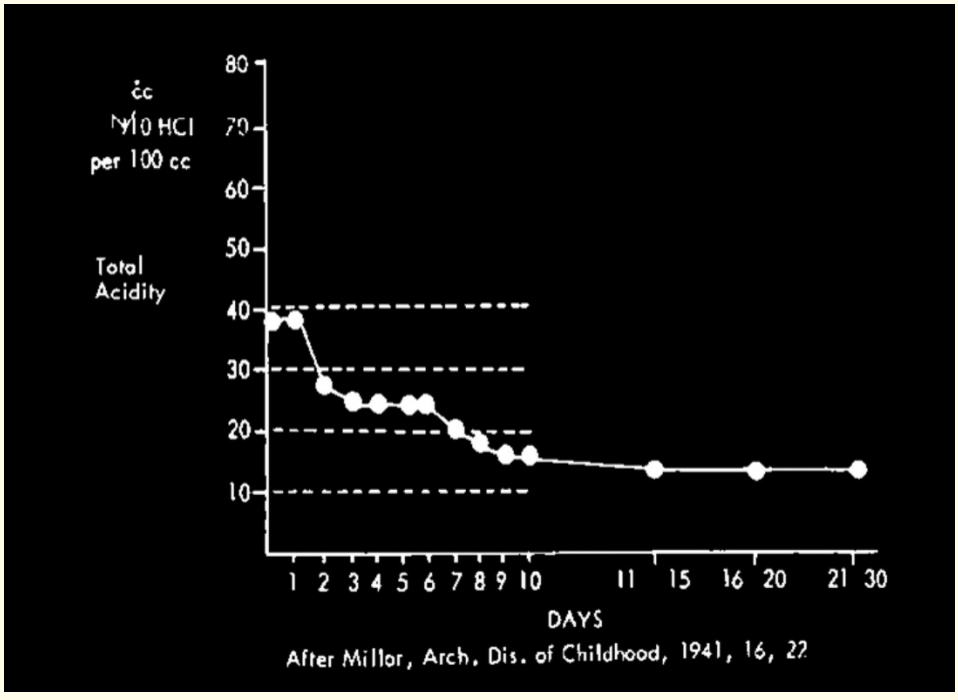

Figure 1: *Total acidity of fasting juice during the first month of life (after Miller).*

Rogers investigated the possibility of gastrin transfer with inconclusive findings. However spontaneously born babies were found to have higher cord gastrin levels than oxytocin-delivered babies. Maternal or, more precisely, placental gastrin transfer in spontaneously born babies was not ruled out [3]. The possibility that spontaneously born babies had as a consequence, more acid has still to be determined [4].

Maternal gastrin is transferred to the dog foetus during labour and causes acid secretion [5]. In human pregnancies maternal gastrin rises steadily during pregnancy before falling just before labour [6]. At this time the concentration of gastrin in the human placenta is many times higher than the concentration in the plasma of the neonate and the implication of trans-placental gastrin transfer in humans is obvious [7].

Fasting gastrin rises significantly from Day1 to Day 4 of life. The Day 4 level exceeds the fasting level in adults. The highly significant individual correlation between Day 1 gastrin and Day 4 gastrin in oxytocin delivered babies coupled with the very short half-life of gastrin, suggests that the Day 1 gastrin is almost entirely neonatal in origin.

Thus the higher Day 1 gastrin in spontaneous births may reflect a placental component which would be responsible for Miller's wave of acidity hyperacidity (Figure 3) [3].

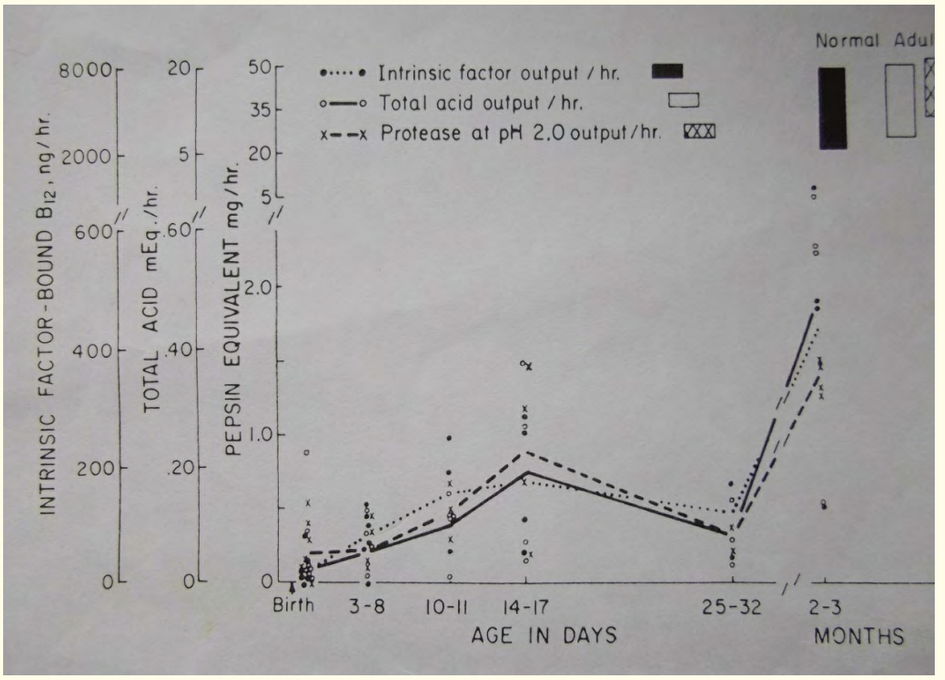

Figure 2: *Fasting gastrin levels from DOL 1 to DOL 4 in 9 oxytocin induced babies and 10 spontaneously born babies. The significant individual correlation between Day 1 and Day 4 only exists in the oxytocin delivered babies. Spontaneously born babies have higher Day 1 fasting gastrins arguably from a maternal contribution.*

Fasting gastrins continue to rise until 2 months of age and there is no post-prandial gastrin response. After this the fasting gastrins begin to fall and a post-prandial gastrin can be detected. After 3 months the gastrins revert to an adult pattern. The fasting level falls and a significant post-prandial elevations develop. A temporary insensitivity of the immature negative feedback between gastrin and antral acidity, is posited as the explanation [8]. In other words gastrin, for a time, is being maximally secreted. It cannot be increased by feeds [9]. Since acidity is also increasing during this time the situation resembles a temporary Zollinger-Ellison syndrome.

Basal acid secretion is little different from stimulated acid secretion in the first 2 days of life supporting this interpretation [10]. When acid secretion is charted peak acid secretion (and peak intrinsic factor and pepsin) is confirmed at around 17 days before it begins to fall as the negative feed-back begins [11] (Figure 2).

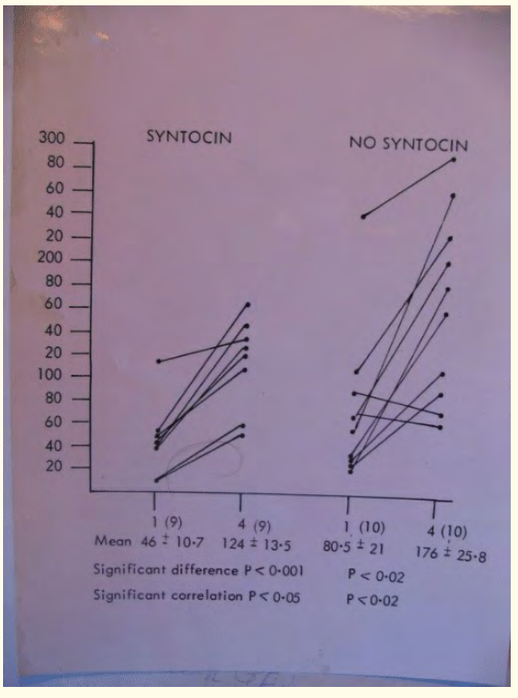

Figure 3: *After Agunod.*

Does the PS baby withstand early enteric infections better?

The basal and stimulated acid secretion of babies with PS is significantly greater than normal, both before and after pyloromyotomy [12,13]. This constitutional hyperacidity, presumably based on the inheritance of a parietal cell mass greater than normal, is the basis for the hyperacidity theory of the cause of PS [14-16]. Such constitutionally hyperacid babies when subject to the normal developmental processes of placental gastrin transfer and a progressively rising functional gastrin level, will become temporarily critically and acutely hyperacid. Acid provoked work hypertrophy of the sphincter and PS is the natural outcome. Outlet obstruction itself is a further stimulus to acid secretion [17].

Do such babies acquire a survival advantage which counteracts the disadvantage of the obvious threat to life from early gastric outlet obstruction?

Specifically, there is compelling evidence that gastric acid provides a barrier to all enteric infections at all ages. Bacteria, viruses, parasites and even prions have been studied and evidence has emerged that a pH < 4 and preferably < 3 is effective [1,18-20].

When acidity is artificially or naturally lowered bacterial diarrhoea is much increased in frequency and infants and children are at special risk [21].

Indeed a prospective study in very low birth weight babies has shown that Ranitidine therapy increases the frequency of necrotising enterocolitis and increases mortality [22]. One type of pathogenic *E. coli* can specially adapt and mutate to survive in pH conditions of 2-2.5 [23]. Hence in this respect, it is perfectly clear.

At this age, the more acid, the better.

Conclusion

In modern practice, once PS is diagnosed pyloromyotomy is freely available and there is almost no mortality. The baby survives and the genetic constitution is preserved. Such babies though inherited hyperacidity, are clearly better able to cope with the many potential forms of enteric infection. Thus those babies have a survival advantage to counteract the usually temporary challenge of gastric outlet obstruction and the genetic predisposition persists.

From the evolutionary point of view, the continuing phenomenon of pyloric stenosis would appear to be the price to pay for an enhanced ability to survive the many infective challenges in the new-born period.

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Conflict of Interest

There are none.

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