

Paper

# Pyloric Stenosis – Do Males and Females Present Differently?

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Accepted 24 March 2011

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## ABSTRACT

**Aims:** In infants with pyloric stenosis we explored (a) if males develop symptoms and present to hospital earlier than females and (b) does any delay in presentation influence the severity of metabolic derangement.

**Method:** A retrospective casenote review of 99 infants who underwent pyloromyotomy (with confirmation of pyloric stenosis) over a two year period (Jan 2006-Dec 2007) in our hospital. The data collected included: sex, age at onset of symptoms, age at presentation to hospital and initial blood results.

**Results:** The group comprised 84 males and 15 females. Symptoms developed at 26 (0-70) days in males and 35 (0-77) in females. (Mann-Whitney  $U=428$ ,  $p=0.04$  two tailed). Males presented to hospital at 34 (13-91) days, females at 45 (13-98) days (Mann-Whitney  $U=391$ ,  $p=0.01$  two tailed). The differences between males and females for (1) age at onset of symptoms and (2) age at presentation to hospital became more significant when weighted averages were calculated using SPSS (Statistical Package for Social Sciences). The lower weighted averages for male infants can be seen in the final table. Increasing duration of symptoms showed a positive correlation with fall in Chloride level. (Spearman's rho:  $r_s = -0.2$ ,  $p=0.049$  two tailed). There was a positive correlation between duration of symptoms and bicarbonate level but this was not significant. ( $r_s=0.06$ ,  $p>0.05$  two tailed). There was a positive correlation between duration of symptoms and pH, but this was not significant ( $r_s=0.12$ ,  $p>0.05$  two tailed).

**Conclusion:** In our hospital, females with pyloric stenosis develop symptoms and present significantly later than males. This should be considered when assessing a female with vomiting outside the usual 20-40 day range.

**Keywords:** pyloric stenosis; gender difference; time to presentation

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## INTRODUCTION

Infantile hypertrophic pyloric stenosis is the most common cause of gastrointestinal obstruction in the first few months of life. The incidence is 1-8 per 1000 live births in the Caucasian population. Salient features of the descriptive epidemiology of pyloric stenosis are well documented in the literature. Pre-eminent among these is the male predominance of the condition over females<sup>1</sup>. A genetic predisposition to pyloric stenosis is well established and it has been associated with several genetic syndromes<sup>2,3</sup>. The literature is also thronged with examples of the various ways in which to perform pyloromyotomy<sup>4,5</sup>. However following a remark that 'girls with pyloric stenosis always present later'; a literature search for similar populations drew a blank. One of the authors was therefore challenged to provide the science behind this statement. Our study had three main objectives: firstly to determine whether females develop the symptoms of pyloric stenosis later than males. We also wanted to establish whether they present to hospital later than males. Lastly we wanted to ascertain whether increasing duration of symptoms is associated with a greater severity in metabolic derangement.

## METHODS

A retrospective case-note review was conducted of all infants who underwent pyloromyotomy (with confirmation of pyloric

stenosis) over a two year period in the Royal Belfast Hospital for Sick Children. Data collected included: sex, gestation, age at onset of symptoms (A) and age at presentation to hospital (B). From these data we calculated the gap (A-B) i.e. the mean duration of symptoms. The venous blood gas results upon admission to hospital were also identified and the biochemical values for pH, bicarbonate and chloride were recorded. The data were analysed using the SPSS 17.0 package. Statistically, all factors were assessed by the Mann-Whitney method. Some data were also analysed using Spearman's rho test of correlation, Chi-squared testing and risk ratios calculation. The threshold p value for statistical significance was  $<0.05$ . Selection criteria for this descriptive study included: all infants in Northern Ireland who had a diagnosis of pyloric stenosis with the International Classification of diseases and a hospital admission for pyloromyotomy between January 2006 and December 2007 in the Royal Hospital Belfast for Sick Children. There were no exclusion criteria in this study.

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**RESULTS**

*General Results*

A total of 99 infants underwent pyloromyotomy in the two year period. The group comprised 84 males and 15 females and therefore approximately 85% of this patient population was male with a 6:1 male-female ratio. The mean age when symptoms developed (A) in the study population was 27 days (range 0-77) and the mean age when children presented (B) was 35 days (range 13-98). The mean duration of symptoms (A-B) was 8 days (range 1-35). 17% of patients began symptoms before the fourteenth day of life and 75% began their symptoms between the fourteenth and forty-ninth day of life.

*Male v Female*

Males developed symptoms at 26 (0-70) days and females at 35 (0-77) days (Mann-Whitney U=428, p=0.04 two tailed). Males presented to hospital at 34 (13-91) days and females at 45 (13-98) days (Mann-Whitney U=391, p=0.01 two tailed). These results, analysed by the non-parametric Wilcoxon-Mann-Whitney test are shown in figure 1.

Ranks				
	Sex	N	Mean Rank	Sum of Ranks
A	Male	84	47.60	3998.00
	Female	15	63.47	952.00
	Total	99		
B	Male	84	47.15	3961.00
	Female	15	65.93	989.00
	Total	99		
Gap	Male	84	49.52	4160.00
	Female	15	52.67	790.00
	Total	99		

Fig 1. Non parametric Wilcoxon-Mann-Whitney test sum of ranks

Figure 2 shows A (age in days when symptoms began), B (age in days when infant was brought to hospital) and the gap (A-B) with their corresponding relationship statistically to the sex of the patient. There was statistical significance with respect to A(0.048) and B(0.019).

Test Statistics <sup>a</sup>			
	A	B	Gap
Mann-Whitney U	428.000	391.000	590.000
Wilcoxon W	3998.000	3961.000	4160.000
Z	-1.973	-2.336	-.394
Asymp. Sig. (2-tailed)	.048	.019	.694
Exact Sig. (2-tailed)	.048	.019	.698

a. Grouping Variable: Sex

Fig 2. Non parametric Wilcoxon-Mann-Whitney test showing statistical significance

This significance is alternatively seen by the percentiles table featured in figure 3, where in both cases A and B the males have a very definite lower weighted average. This deduction made from these results is that males tend to develop symptoms earlier, and present to hospital earlier than females. The gap between males and females increases as one

moves from the 25<sup>th</sup> to the 75<sup>th</sup> percentile and therefore the table clearly demonstrates that at the upper percentile the gap between males and females is even wider.

Percentiles					
	Sex	Percentiles			
		25	50	75	
Weighted Average(Definition 1)	A	Male	18	26	31
		Female	22	34	52
	B	Male	25	30	42
		Female	34	40	59
	Gap	Male	3	7	10
		Female	4	6	13

Fig 3. Percentiles Table

*Biochemical Results*

From figure 4 it can be seen that increasing duration of symptoms showed a positive correlation with fall in Chloride level. (Spearman's rho: rs= -0.2, p=0.049 two tailed). There was a positive correlation between duration of symptoms and (a) bicarbonate level and (b) pH but this was not significant. (Bicarbonate: rs=0.06, p>0.05; pH: rs=0.12, p>0.05 two tailed).

Correlations					
		Cl	HCO3	pH	Gap
Spearman's rho	Cl	1.000	-.669**	-.494**	-.200*
			.000	.000	.049
			97	94	97
HCO3	Cl	-.669**	1.000	.342**	.062
			.000	.001	.555
			94	94	94
pH	Cl	-.494**	.342**	1.000	.122
			.000	.001	.237
			96	94	96
Gap	Cl	-.200*	.062	.122	1.000
			.049	.555	.237
			97	94	96

\*\* Correlation is significant at the 0.01 level (2-tailed).  
\* Correlation is significant at the 0.05 level (2-tailed).

Figure 4: Table showing biochemical analysis by Spearman's rho

A categorical analysis of the 99 infants was undertaken with Chi-square testing and risk estimate statistical analyses. The two categories were: pH <=7.5 and >7.5 tabulated against infants whose delay in presentation to hospital was <=5days and >5days respectively. 75% of infants on presentation to hospital had a pH of <=7.5, and of this 75% subgroup, 71% were delayed for more than 5 days in presenting to hospital. The odds ratio was calculated as 1.55 and is not statistically significant as the 95% confidence intervals include 1(0.588-4.087). However we can deduce from the risk estimate result that infants are 55% more likely to have a metabolic alkalosis if the presentation to hospital is delayed for > 5 days.

**DISCUSSION**

An observational remark was shown to be supported in our data population. Females not only developed the symptoms of pyloric stenosis later than males but they also presented to hospital later in addition. These results were statistically significant in both categories. Males displayed lower weighted averages in both categories in the percentiles tables, again confirming that they develop symptoms and present earlier than females. On moving from the 25<sup>th</sup> to the 75<sup>th</sup>

percentile, the gap between the sexes widened. Indeed at the 75<sup>th</sup>, the gap is widest, again showing that females develop symptoms and present to hospital later than males. Increasing duration of symptoms showed a positive correlation with fall in chloride level. This was statistically significant. Although the results also showed a positive correlation between duration of symptoms and both bicarbonate and pH levels, unfortunately these results were not statistically significant.

The main limitation of this study is the small sample size, however the Royal Belfast Hospital for Sick Children is the Paediatric surgical unit in Northern Ireland and therefore our 2 year period is a good representation of the population. Given this the study does show with statistical significance, that females develop the symptoms of pyloric stenosis and present to hospital significantly later than males. This should be taken into account when assessing females with vomiting outside the usual 20-40 day range.

The authors have no conflict of interest

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