THE ANAL POSITION INDEX: A SIMPLE METHOD TO DEFINE THE NORMAL POSITION OF THE ANUS IN NEONATE & ITS SIGNIFICANCE IN DIAGNOSIS CONSTIPATION

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ABSTRACT

Purpose: The anterior displacement of the anus (ADA) can be recognized as one of common congenital anomalies of anorectal region. This abnormality is easily diagnosed by simple physical examination. The purpose of this study was to determine the normal position of anus using anal position index (API) as a measurement method and to emphasize its importance in diagnosis of ectopic anus and to investigate the association of anterior displacement of the anus with constipation during infancy. Materials and methods: This work was carried out at Al-Azhar University Hospital (Dameita Egypt) in the period from January 2010 to June 2011. This cross-sectional study was performed on 400 neonates equally, boys and girls who were all delivered at full term without any malformations. Anal position index, which is the ratio of anus-fourchette distance in girls and anus-scrotum distance in boys to the distance between coccyx and fourchette/scrotum, was calculated in all cases. To make correct measurements, transparent adhesive tape was used longitudinally on midperinum in a way that it covered the anus. Then fourchette/scrotum, anus center and the lower margin of coccyx were marked on it. Distances marked on each tape were then measured with the standard ruler. Results: Overall
incidence of ADA is 24.25%, while the incidence is significantly higher in females than males (32.0% and 16.5%, respectively; p <0.01). The incidences of ADA in infants with constipated events during first 4 months were higher than normal infants. **CONCLUSIONS:** Anal position index is a simple method for determination of normal position of anus in children, especially those who are referred for chronic constipation. API cannot be considered as the sole indicator for the surgical intervention.

**INTRODUCTION**

Anterior displacement from the normal position of the anus is reported to be a common developmental abnormality of anorectal malformation (1). "Normal anal position" was defined as the midway between the vaginal fourchette (scrotum) and the tip of the coccyx by relying on inspection only. However, in a less severe case, slight anterior displacement is very difficult to diagnose without using diagnostic measurement tools (2,3). The quantitative measurement to define the normal position of the anus was first proposed in 1984.

Reisner et. al presented a simple method using the anal position index (API) which is the ratio of anal-fourchette distance to coccyx-fourchette distance for females and the ratio of anal-scrotum distance to coccyx-scrotum distance for males, to define the normal position of the anus in the newborn(1). They suggested that API of less than 0.46 in boys and less than 0.34 in girls was indicative of anterior displacement of the anus.(4).

One of the most common disorders of anorectal function in infancy and childhood is constipation. Although, the most common cause of constipation is functional, congenital anatomic malformations in ano-rectal area may be responsible in some of these cases (5). Similar to many other abnormalities, congenital ano-rectal malformations occur in a wide spectrum of severity. Slight
anterior displacement of the anus is the least severe form of anorectal malformations (Fig. 1.A, B).

In the neonates, these abnormalities are easily diagnosed at birth with simple inspection; yet ectopic anterior anus is very difficult to diagnose without using diagnostic measurement tools (2, 6).

As a result of ADA, the acceptable vulvo-anal distance is not achieved, and soiling of vulva might continue to occur with its associated risks, and the child is likely to have constipation off and on.(7).

However, the more recent cross-sectional studies fail to demonstrate a direct association between ADA and constipation (8, 9).

The aim of the present study is to describe the simple quantitative technique for describing the normal anal position and to investigate the association of anterior displacement of the anus with constipation during infancy.

**MATERIALS AND METHODS**

This was a cross-sectional study conducted from January 2010 to Jun 2011 on neonates born at Alazhar university hospital (Damieta) and a private NICU. A total number of 400 neonates were equally divided into 200 boys 200 girls. The majority of newborns were delivered at full term without any malformations.

All congenital malformations or syndromes easy to notify, such as Down syndrome, anencephaly or congenital heart diseases were excluded. The presence of abnormalities in genito-urinary area and lower extremities, such as ambiguous genitalia, an imperforate anus and achondroplasia, were also included in the exclusion criterion. An occult abnormalities that looked normal on physical examination and needed further investigations for diagnosis like
Hirschsprung’s disease or congenital spine deformity were included in exclusion criteria.

The cases (200 boys, 200 girls) were randomly selected. All neonates were 1-10 days old, without any malformations especially in the perineum. Boys and girls were matched for variables such as body length, weight, head circumference, gestational age and Time of the first meconium passing (Table 1). To determine API, the neonate was held in jeno-pectoral position and transparent scotch tapes were used on the longitudinal axis of mid-perineum.

Anal position index is the ratio of anus-fourschette distance in girls and anus-scrotum distance in boys to the distance between coccyx and fourschette/scrotum. It was calculated in all cases. To make correct measurements, transparent adhesive tape was used longitudinally on mid-perinus in a way that it covered the anus. Then fourschette/scrotum, anus center, and the lower margin of coccyx were marked on it. Distances marked on each tape were then measured with the standard ruler. (Fig 2)

**STATISTICAL ANALYSIS**

Demographic data, anal-fourchette (scrotum) distance, coccyx-fourchette (scrotum) distance, and anal position index were expressed as mean and standard deviation (SD). Data were analyzed using the Chi-square or Fisher exact test. Continuous variables were compared by using a Student’s t-test. Pearson’s correlation coefficient was performed to test the correlation among gestational age, anthropometric parameters, and anal position index. Statistical analyses were performed using a SPSS 11.5 software package. Differences were considered as significant if p-value <0.05.
RESULTS

Four hundred neonates were included into this study, 200 (50%) were males and 200 (50%) females. The majority (88.1%) of newborns were term newborns and 10.9% were premature newborn; only 1.0% was post-term newborns. The mean anal position index (API) in male neonates was 0.51 (SD=0.07) whereas in female neonates was 0.38 (SD=0.08) (p <0.001). Based on API measurements, anterior displacement of the anus (ADA) was diagnosed in 97 neonates of 400 (24.25%). Demographic characteristics and anthropometric data of neonates with ADA or normal API were detailed in Table 1.

Table 1: Demographic characteristics and anthropometric data of 400 neonates.

<table>
<thead>
<tr>
<th></th>
<th>All(n= 400)</th>
<th>ADA(n= 97)</th>
<th>* Normal API(n= 303)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>200</td>
<td>33 (16.5)</td>
<td>167 (83.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Female</td>
<td>200</td>
<td>64 (32.0)</td>
<td>136 (68.0)</td>
<td></td>
</tr>
<tr>
<td>Gestational age (week) (SD)</td>
<td>38.3(1.8)</td>
<td>38.2 (1.9)</td>
<td>38.3( 1.8)</td>
<td>0.55</td>
</tr>
<tr>
<td>Birth weight (g) (SD)</td>
<td>2926.8(458.5)</td>
<td>2966.0(421.6)</td>
<td>2913.8( 470.0)</td>
<td>0.32</td>
</tr>
<tr>
<td>Length (cm) (SD)</td>
<td>51.4(2.9)</td>
<td>51.4 (2.3)</td>
<td>51.4 ( 3.1)</td>
<td>0.84</td>
</tr>
<tr>
<td>Head circumference (cm) (SD)</td>
<td>32.9(1.6)</td>
<td>32.9 (1.6)</td>
<td>32.8( 1.6)</td>
<td>0.60</td>
</tr>
<tr>
<td>Anal position index (SD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>0.44 (0.1)</td>
<td>0.34 (0.06)</td>
<td>0.48 (0.08)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Females</td>
<td>0.51(0.07)</td>
<td>0.40 (0.05)</td>
<td>0.53 (0.05)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Time at the first meconium passing (hour) (SD)</td>
<td>5.1± 6.0</td>
<td>5.1 (6.0)</td>
<td>5.1( 6.0)</td>
<td>0.99</td>
</tr>
</tbody>
</table>

ADA= anterior displacement of the anus, API= anal position index
Figure 1: How can measure API in female (A), and male (B). fourschette/scrotum, anus center, and the lower margin of coccyx were marked on the transparent adhesive tape.

Figure 2. Anterior displaced anus in female neonats (A), and (B).

24 of 97 neonates (24.7%) with ADA, complained from constipation during neonatal and early infancy period (first 4 months).

DISCUSSION

The anal position was first described by Leape and Ramenofsky as the midway between the vaginal fourchette (scrotum) and the tip of coccyx (3). In 1978, two separated reports, by Leape and Ramenofsky(10) and Hendren(11), described cases of slight anterior displacement of the anus who presented with chronic constipation. However, the diagnosis relied on inspection only. The measurement method of normal anal position was not stated until 1984. Reisner et al were the first to report the simple method to measure the normal position of the anus as anal position index (API) (1).
### Table 2: Anal position index from pre-existing reports.

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Age group</th>
<th>number</th>
<th>Anal position index (SD)-male</th>
<th>Anal position index (SD)-female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reisner 1984 (1)</td>
<td>Israel</td>
<td>Newborn + 4-18 months</td>
<td>200 (100 M*, 100 F**)</td>
<td>0.58 (0.06)</td>
<td>0.44 (0.05)</td>
</tr>
<tr>
<td>Bar-Maar and Eitan 1987 (12)</td>
<td>Israel</td>
<td>3 days - 12 years</td>
<td>104 (74 M, 30 F)</td>
<td>0.56 (0.20)</td>
<td>0.39 (0.09)</td>
</tr>
<tr>
<td>Genc 2002 (13)</td>
<td>Turkey</td>
<td>Newborn</td>
<td>60 (26 M, 34 F)</td>
<td>0.53 (0.05)</td>
<td>0.46 (0.08)</td>
</tr>
<tr>
<td>Mohta 2004 (9)</td>
<td>India</td>
<td>Newborn</td>
<td>387 (300 M, 87 F)</td>
<td>0.43 (0.05)</td>
<td>0.37 (0.06)</td>
</tr>
<tr>
<td>Davari 2006 (14)</td>
<td>Iran</td>
<td>Newborn</td>
<td>400 (200 M, 200 F)</td>
<td>0.54 (0.07)</td>
<td>0.42 (0.08)</td>
</tr>
<tr>
<td>Thai 2008 (4)</td>
<td>Thailand</td>
<td>Newborn</td>
<td>403 (203 M, 200 F)</td>
<td>0.51 (0.07)</td>
<td>0.38 (0.08)</td>
</tr>
<tr>
<td>Present study</td>
<td>Egypt</td>
<td>Newborn</td>
<td>400 (200 M, 200 F)</td>
<td>0.48 (0.06)</td>
<td>0.34 (0.08)</td>
</tr>
</tbody>
</table>

The existing reports on the normal anal position indexes from different institutes were varying (Table 2). The reports from Oriental countries, including the present study, were found to be different from the Western countries. Factors affecting the difference of API are poorly understood but may include the difference in age group and lower body weight in Eastern populations (9).

Anal position indexes in the present study are compared with other studies that had significantly higher ratio in boys than in girls. The present study found the consistent differences of API between gender identity even in the sub-grouping analysis in premature newborn and in term newborns.

Rerksuppaphol and Rerksuppaphol also showed that in neonates, ADA is common with an incidence of approximately 25%. Unlike other anorectal malformations and Hirschsprung’s disease which have higher incidence rate in males, ADA occurs more often in females than in males with a ratio of approximately 2:1 (15).

At birth, male newborns had higher anthropometric parameters including birth weight, length and head circumference than female newborn the same as the data from the national surveillance. These parameters had positive
correlations with gestational age. Moreover, anus-fourchette (scrotum) distance, and coccyx-fourchette (scrotum) distance also had positive correlation with other anthropometric parameters. However, the present study showed that the anal position index was not affected by birth weight, length, head circumference, or gestational age. This may be explained by the constant ratio of anus-fourchette (scrotum) distance to coccyx-fourchette (scrotum) distance in human subjects (4).

The association between anterior displacement of the anal opening and constipation is still controversial (9,11,12). In a large case series of 134 patients with ADA, nearly all patients have constipation from birth or from the time of weaning from breast-feeding and require surgical correction (11). This association has been further supported by Leape and Romenofsky and Upadhyaya (10,16). However, studies that are more recent do not described any association between anal position and constipation (8, 11, 12).

The correlation between anterior displacement of the anal opening and constipation has been demonstrated (11,4,17). However, in recent studies by Herek et al(8) and Mohta et al(9), the incidence of constipation in children with normal anal index and those with low anal index indicative of anterior displaced anus was not significantly different. Malformation of the middle portion of the external sphincter and weakness of the corresponding segment of the anal canal has been postulated to be the cause of constipation in anterior abnormal opening of anus (16).

In the present study about 24.7% of cases with ADA, complained from constipation during neonatal and early infancy period (first 4 months). Clearly further studies are required to determine the magnitude of constipation problems in children with anterior displacement of the anus with long-term follow up of
cohorts, in which the time point of constipation is known and no confounding factors of constipation exist, are required.

**CONCLUSION**

Anal position indexes in the newborn infants are 0.51 and 0.38 in male and female, respectively. It appears to be significantly different in anal position index between genders in the newborn in which there is a significantly higher API of male than API of female newborn. There were no significant effects of gestational age or anthropometric parameters on API in each gender identity. These API data may help pediatric surgeons to decide for the most accurate position of anus in case anorectoplasty is required. Moreover, it can prevent complications of incorrect anal placement such as fecal incontinence and constipation.

Clearly further studies are required to determine the magnitude of constipation problems in children with anterior displacement of the anus. The authors advocate that the long-term follow up of cohorts, in which the time point of constipation is known and no confounding factors of constipation exist, are required.
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