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Correlation between sacral ratio and primary enuresis

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ABSTRACT

Background: Enuresis is defined as the repeated voiding of urine into clothes or bed at least twice a week for at least 3 consecutive months in a child who is at least 5 yr of age and has a high prevalence in school aged children. In primary enuresis (PE) children have never gained control over urination or has been dry for <6 months. While in secondary enuresis children have developed incontinence after a period of at least 6 months of urinary control.

Objectives: The aim of this study was to investigate a possible relation between PE and sacral ratio (SR) in 5-9 aged children.

Patients and Methods: 118 children with aged 5-9 year were enrolled in this case-control study. All them were divided into two aliquots groups of 59 patients. The case study (children with PE) and the control (children without PE) groups were matched in age and sex. SR based on antero-posterior plain radiograms of pelvis was calculated. Results were then analyzed using Chi square and student t-test as appropriate.

Results: There were no significant differences between the two groups regarding age and gender. Mean SR in case and control group was 0.89 and 0.90, respectively. Moreover, there was no significant difference between the two groups ($p=0.82$). Only 1 child (1.6%) in case group showed abnormal SR while this was 7 children (11.9%) in the control group.

Conclusions: This study showed that, there was no significant difference between children with PE and those without PE in terms of SR. However, multicenter and larger sample size is recommended for definite decision of this finding.

Implication for health policy/practice/research/medical education:

To investigate a possible relation between Primary Enuresis (PE) and Sacral Ratio (SR) in 5-9 aged children, a study was conducted on 118 children within these ages. This study showed that, there was no significant difference between children with PE and those without PE in terms of SR. Multicenter and larger sample size is recommended for definite decision of this finding.

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1. Background

Enuresis is defined as the repeated voiding of urine into clothes or bed at least twice a week for at least 3 consecutive months in a child who is at least 5 yr of age and has a high prevalence in school aged children (5-15%) (1, 2). In Primary enuresis (PE) children have never gained control over urination (about 75% of cases), while in secondary enuresis (SE) children have developed incontinence after a period of at least 6 months of urinary control (25% of cases) (3).

Enuresis is mostly common in male gender (9% among 7 year-old and 7% among 10 year-old boys) (4). Normally, about 90-95% of children by the age of 5 year-old can gain control over urination, which is why the diagnosis is usually made upon this age (5). However, children and parents' anxiety over enuresis can cause additional psychological problems (6). These children refuse to urinate and this will cause overflow incontinence (7, 8). Previous researches have suggested that there is a strong genetic background to enuresis specially in PE (9) although there is a positive family history in half of the SE cases as well (10). It has been stated that, if mother or father has a positive history of enuresis, chances of enuretic child would be 44% and 43%, respectively. This chance will be raised if both parents have a positive history (77%) (9). In about less than 5% of children with PE and only 1% of children with SE, the enuresis is accompanied with a congenital organ disorder. Nearly in all of PE cases, this disorder is a delay in sphincter control mechanism (10).

Sacrum anomalies, like hypoplasia (which is underdevelopment of sacrum) or aplasia (which is congenital lack of sacrum), are accompanied with urinary disorders (11, 12). Today, the association between sacral agenesis and the neuropathic bladder, voiding dysfunction with or without secondary reflux is well known (13-15). The ana-

tomical proximity of sacrum and distal ureters might fabricate co-occurrence of developmental abnormalities in both organs. Although plain radiograms are used to investigate bony sacral abnormalities, assessing them can be difficult. In 1995, Pena introduced a novel method to evaluate bony indexes of sacrum as a predictive value of anorectal malformations and voiding dysfunction (5). He called it sacral ratio (SR) which is used by several other investigators thereafter (15, 17-19).

2. Objectives

Due to insufficiency of research, this study aimed to evaluate the relation between sacral ratio and primary enuresis.

3. Patients and Methods

In this study during March 2006– March 2007, we evaluated 5-9 year-old children who were presented in Pediatrics and Urology Clinics of Amirkabir and Valiasr Hospitals, Arak, Iran. The age of 9 year-old was selected as the maximum due to changes made to sacral ratio after the puberty. Control group was consisted of 5-9 year-old children with other complaints such as trauma, stomach pain(stomachache), backache or pelvic pain and no voiding dysfunction, while the case group was consisted of age matched children with enuresis.

To diagnose enuresis and rule any secondary cause out, full urinalysis and urine culture tests, bilateral kidney, bladder and ureters sonography and plain radiography of pelvis were provided. At this work, children with no abnormality in urinalysis (Red blood cells or white blood cells, bacteruria or glucosuria indicative of probable secondary cause), sonography (renal calculi, hydronephrosis or vesico ureteral reflux) and sacral bone (e.g. spina bifida) were enrolled. Patients with any of the above or clinical symptoms like

dysuria, frequency, urgency and hesitancy, were excluded from the case group. Finally, 59 cases were selected for each group.

To calculate the Sacral Ratio anteroposterior (AP) pelvic radiograms were used. Three lines were drawn as instructed below for each radiograph:

X: A horizontal line connecting uppermost parts of iliac crest of both sides.

Y: A horizontal line connecting lowermost parts of sacroiliac joints of both sides.

Z: A horizontal line passing the lowermost part of sacrum.

All of these lines should have been parallel to each other, otherwise we excluded the patient from the study (19, 20).

SR was defined as proportion of YZ to XY ($SR = YZ/XY$). Pena was described as a normal limits for SR as ≥ 0.74 in AP and ≥ 0.77 in lateral view (5).

All radiographic images were obtained and assessed by the same radiologist. None of the cases had bowel preparation. Therefore, to get quality radiograms for detecting the tip of sacrum, a direct digital radiography system was used in most of the patients. Due to ethical issues, no supplementary lateral or oblique views were ordered and a few patients with doubtful radiograms were excluded from the study and were replaced with similar matching cases. Since obtaining lateral views meant additional X-ray exposure, the study was restricted to assess SR ratio in AP views.

The results were analyzed by SPSS software, version 15.00, using students t-test, and the Chi-square test as appropriate, depending on whether the data were continuous or not. $p < 0.05$ considered to indicate statistical significance.

This study is approved by Ethical committee of Arak University of Medical Sciences and a written consent was obtained from all of parents

whose children were involved in the study and they were free to leave the study. In all stages we were loyal to Helsinki declaration principles.

4. Results

There were 59 children in our case group with PE [22 (37.3%) male, 37 (62.7%) female and mean age of 7 ± 0.15]. In this group, only 1 child (1.6%) had abnormal SR ($0.74 >$). There was no relation between sex and normal or abnormal SR ($p = 0.19$). Mean SR was 0.86 ± 0.06 in boys and 0.91 ± 0.12 in girls, indicative of no significant difference ($p = 0.08$).

In the control group, from 59 cases [20 (33.9%) male, 39 (66.1%) female and mean age of 7.5 ± 0.14], 7 (11.9%) had abnormal SR. Girls were more likely to have normal sacral ratio than boys ($p = 0.02$). Mean SR was 0.9 ± 0.19 in boys and 0.9 ± 0.14 in girls, showing no significant difference ($p = 0.98$).

The mean SR in case and control group was 0.89 and 0.90, respectively. There was no significant difference in terms of mean SR in case and control groups ($p = 0.82$).

5. Discussion

In this study we compared the SRs of 59 children with PE and 59 children without enuresis. Mean SR of both groups seems to have no apparent relation and the two groups were alike. Although there was no relation in the case group in terms of sex and normal or abnormal SR. Girls were more likely to have normal SR than boys in the control group.

This was against the results of Kajbafzadeh and Rasuli, who compared SRs of children (aged less than 15) with and without urinary or fecal complaints (21). In their case group (193 patients), SR was abnormal in 13.2% and 13.3% of the patients with urinary and fecal complaints,

respectively, while it was 0.5% in control group. Therefore, SR was addressed as a valuable index for prediction of urinary or fecal complaints.

Warne et al. evaluated 50 pelvic radiographs (30 children with anorectal abnormality and 20 healthy children) (22). Although they concluded that SR is a good measure for sacral development but the range of SRs they used was too wide to demonstrate the difference of normal and abnormal SRs in a fashionable way. Khalegh Nejad (23) and Ahmadi (24). suggested that SR is a good predictor of fecal continence after colorectal surgery and it is a valuable index for sacral development.

The heterogeneity between our result and others can be due to sample size limitations. In addition, Amirkabir and Valiasr Hospitals are referral centers so the results may not be extendable to a wider population.

6. Conclusions

This study showed no apparent correlation between primary enuresis and Sacral Ratio. However, finding a correlation would be an easy and cost effective way to clinically diagnose and treat enuresis. A multicenter study with larger sample size, to investigate a correlation between primary enuresis and Sacral Ratio is suggested.

Authors' contributions

PY defined the aim of research and the study design. MRFF and AC participated in the design of the study and performed the statistical analysis and wrote some parts of the draft. PY prepared the manuscript. All authors read and approved the final manuscript.

Conflict of interest

The author declared no competing interests.

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References

1. Deshpande AV, Craig JC, Smith GH, Caldwell PH. Factors influencing quality of life in children with urinary incontinence. *The Journal of urology*. 2011;186(3):1048-52.
2. Yousefi P, Baghcheghi N, Koohestani H. *Renal Disease in children*. Arak: Payame digar; 2011.
3. Richared E, Behrman MD, Robert M, Jach S, Elder JS. Voiding Dysfunction. In Kliegman MD. *Nelson Textbook of Pediatrics*, 19th ed. Philadelphia: Saunders; 2007. available from: <http://www.mdconsult.com/books/linkTo?type=bookPage&isbn=978-1-4377-0755-7&eid=4-u1.0-B978-1-4377-0755-7.00537-6--s0050>
4. Austin PF, Ritchey ML. Dysfunctional voiding. *Pediatrics in review / American Academy of Pediatrics*. 2000;21(10):336-41.
5. Pena A. Anorectal malformations. *Seminars in pediatric surgery*. 1995;4(1):35-47.
6. Yousefi P, Salehi B, Firouzifar MR, Sheikholeslami H. The Correlation between Attention Deficit Hyperactivity Disorder and Enuresis in Children with Nocturnal Enuresis. *Journal of Isfahan Medical School*. 2012;30(184).
7. Shea VK, Cai R, Crepps B, Mason JL, Perl ER. Sensory fibers of the pelvic nerve innervating the Rat's urinary bladder. *Journal of neurophysiology*. 2000;84(4):1924-33.
8. Bower WF. Self-reported effect of childhood incontinence on quality of life. *Journal of wound, ostomy, and continence nursing : official publication of The Wound, Ostomy and Continence Nurses Society / WOCN*. [Multicenter Study]. 2008;35(6):617-21.
9. Kodman-Jones C, Hawkins L, Schulman SL. Behavioral characteristics of children with daytime wetting. *The Journal of urology*. 2001;166(6):2392-5.
10. Evans JH. Evidence based management of nocturnal enuresis. *BMJ*. 2001;323(7322):1167-9.
11. Gladh G, Persson D, Mattsson S, Lindstrom S. Voiding pattern in healthy newborns. *Neurourology and urodynamics*. 2000;19(2):177-84.
12. Jansson UB, Hanson M, Hanson E, Hellstrom AL, Sillen U. Voiding pattern in healthy children 0 to 3 years old: a longitudinal study. *The Journal of urology*. 2000;164(6):2050-4.

13. Emami-Naeini P, Nejat F, Rahbar Z, Kajbafzadeh A, El Khashab M. Urological manifestations of sacral agenesis. *Journal of Pediatric Urology*. 2012;8(2):181-6.
14. Macedo M, Martins JL, Freitas Filho LG. Sacral ratio and fecal continence in children with anorectal malformations. *BJU international*. 2004;94(6):893-4.
15. Wilmshurst JM, Kelly R, Borzyskowski M. Presentation and outcome of sacral agenesis: 20 years' experience. *Developmental medicine and child neurology*. 1999;41(12):806-12.
16. Assadi F. The epidemic of pediatric chronic kidney disease: the danger of skepticism. *J Nephrology* 2012;1(2):61-4.
17. Levitt MA, Patel M, Rodriguez G, Gaylin DS, Pena A. The tethered spinal cord in patients with anorectal malformations. *Journal of pediatric surgery*. 1997;32(3):462-8.
18. Demirbag S, Senel E, Cetinkursun S. Sacral ratio and fecal continence in children with anorectal malformation. *BJU international*. 2005;95(6):909.
19. Torre M, Martucciello G, Jasonni V. Sacral development in anorectal malformations and in normal population. *Pediatric radiology*. 2001;31(12):858-62.
20. Yamazaki Y, Yago R, Toma H. Sonographic characteristics of the urinary tract in healthy neonates. *The Journal of urology*. 2001;166(3):1054-7.
21. Sillen U, Solsnes E, Hellstrom AL, Sandberg K. The voiding pattern of healthy preterm neonates. *The Journal of urology*. 2000;163(1):278-81.
22. Kajbafzadeh AM, Rasuli N. Correlation between the sacral ratio and the outcome of VUR. *BJU* 2001; 87: 61.
23. Warne SA, Godley ML, Owens CM, Wilcox DT. The validity of sacral ratios to identify sacral abnormalities. *BJU international*. 2003;91(6):540-4.
24. Khalegh Nejad Tabari A, Saeeda M. The results of posterior sagittal anorectoplasty in anorectal malformations. *Archives of Iranian Medicine* 2005; 4(8): 272-6. Available from: <http://amuj.jo.arakmu.ac.ir/En/Forms/html.aspx?arid=7082>
25. Ahmadi J, Kajbafzadeh A, Kalantari M, Nahvi M, Hadipoor A, Ashjaei B, et al. Evaluation of sacral ratio as prognostic factor in patients with anorectal malformations. *Acta Medica Iranica J* 2005; 2(43): 143-6. Available from: http://journals.tums.ac.ir/upload_files/pdf/_/751.pdf