ORIGINAL ARTICLE

Colonic transit times and behaviour profiles in children with defecation disorders

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Aims: To evaluate children referred for defecation disorders using the child behavioural checklist (CBCL).
Methods: A total of 215 patients were divided into three groups: 135 (5–14 years of age) with paediatric constipation (PC), 56 (5–17 years) with functional non-retentive faecal soiling (FNRFS), and 24 (5–16 years) with recurrent abdominal pain (RAP). Behavioural scores were correlated with colonic transit time (CTT) and anorectal function parameters (manometry and EMG).
Results: No significant differences in the mean CBCL scores were found among the three patient groups. However, children with PC and FNRFS had significantly more behavioural problems than the Dutch normative sample, while children with RAP had scores within the normal range. No significant differences were found between CTT in the patient groups, with respect to the CBCL. Similarly, no significant difference existed between children able or unable to relax their pelvic floor muscles during defecation attempts and their behaviour profiles.
Conclusion: There seems to be no relation between colonic/anorectal function and specific behavioural profiles. On the other hand, children with defecation disorders show more behavioural problems than do controls.

Defecation disorders such as constipation, encopresis, and recurrent abdominal pain (RAP) are common problems in children, accounting for 3–10% of visits to primary care facilities.[1]

The possible role of psychological factors in constipation and encopresis is unclear. Some use the term ''psychogenic constipation'', and some consider that unexplained encopresis is triggered by unconscious anger. The association between stressful life events and constipation, encopresis, or RAP has been reported by several investigators.[2 3] In addition to this, coercive toilet training has been suggestive as a causative factor in constipation and encopresis.

Some studies emphasise the importance of behavioural disturbances or personality disorders, suggesting that constipation and encopresis require psychiatric treatment.[4 5] However, others argue that these psychological disturbances are secondary to physiological abnormalities, and suggest treatment within paediatric settings.[6 7]

To our knowledge, no studies in children have evaluated the correlation between colonic transit time, anorectal function parameters (manometry and electromyography (EMG)), and behaviour profiles. The aims of this study were threefold:

- To describe the behaviour profiles in children with different functional gastrointestinal disorders
- To investigate the possible correlation between behaviour profiles and colonic transit time
- To examine the correlation between behaviour profiles and abnormal defecation dynamics on anorectal manometry.

METHODS

In this prospective study, 223 consecutive patients were referred by school physicians, general practitioners, paediatricians, or psychiatrists for defecation disorders or abdominal pain to our paediatric motility unit during a five year period. Patients were divided into three groups. Group I consisted of children with paediatric constipation (PC)—that is, when patients met at least two of the four following criteria: (1) stool frequency less than three per week; (2) two or more soiling/encopresis episodes per week; (3) periodic passage of very large amounts of stools at least every 7–30 days; (4) an abdominal or rectal palpable mass. Group II consisted of patients with functional non-retentive faecal soiling (FNRFS). In such children soiling of the underwear was present, but there were no symptoms or signs suggestive of constipation. Group III consisted of children with episodes of non-specific recurrent abdominal pain (RAP), occurring at least three times per week and severe enough to interfere with normal activities over a period of at least three months. These children had no symptoms or signs indicating constipation.[8] Children with Hirschsprung's disease, spinal or anorectal anomalies, previous colonic surgery, inborn errors of metabolism, or developmental delay were excluded.

Each child underwent a complete work up which encompassed a detailed medical history, and a thorough physical examination including rectal examination. In addition, anorectal manometry and colonic transit time studies were performed and a child behaviour checklist was completed by the parents.

The study was approved by the hospital's medical ethical committee. Written informed consent was obtained from patients and/or their parents.

Child behaviour checklist

The child behaviour checklist (CBCL) is an established and validated checklist.[9 10] On the CBCL/4–18, parents give behavioural ratings of their child on 118 items. Parents are asked if an item is untrue, somewhat or sometimes true, or very true/often true. The scores on these items can be

Abbreviations: CBCL, child behaviour checklist; CTT, colonic transit time; EAS, external anal sphincter; EMG, electromyography; FNRFS, functional non-retentive faecal soiling; PC, paediatric constipation; RAP, recurrent abdominal pain; TBP, total behaviour problem score

summed up to a total behaviour problem score (TBP). The items of the CBCL are divided into eight domains, each of which takes other aspects of behaviour into account: withdrawn, somatic complaints, anxious/depressed, social problems, thought problems, attention problems, delinquent behaviour, and aggressive behaviour.[9]

Most of the eight domains within the CBCL can be subdivided into two subscales: internalising and externalising problems. These two subscales reflect a distinction between inhibited/anxious behaviour (internalising) on the one side and aggressive, antisocial behaviour (externalising) on the other side. The internalising subscale is a summation of withdrawn, somatic complaints, and anxious/depressed. The externalising subscale is comprised of aggressive behaviour and delinquent behaviour.

For the total behaviour problem scores (T scores) we computed the 90th centile from the Dutch normative data.[10] The 90th centile of the total behaviour problem score is a well validated cut-off for the so called ''clinical range'' that discriminates between non-referred children and referred children to mental health centres.[10 11] We used the US normative data to compute normalised T scores for the eight domains and the internalising and externalising subscales.[9] For the statistical analysis we performed one way analysis of variance with post hoc multiple comparisons (Tukey $p<0.05$) on the mean normalised T scores.

Colonic transit time

Total and segmental analysis of colonic transit times (CTT) was appraised as reported previously by Metcalf and colleagues.[12] All patients ingested an identical capsule with 20 radio-opaque markers on three consecutive days at 9.00 am. Abdominal *x* ray examinations were performed one and four days after ingestion of the last capsule at the same time in the morning. Additional abdominal *x* ray examinations were performed 7, 10, and 13 days after ingestion of the last capsule, if more than 20% of markers were still present. Markers were counted in the right, left, and recto-sigmoid regions, and mean segmental transit times were calculated according to a previously described formula.[12 13] Transit times were compared with those of healthy controls. The normal range for segmental and total CTT was taken from the upper limits (mean +2 SD, hours) in these children.[13] Colonic transit was delayed when total CTT exceeded 62 hours. Laxative therapy was omitted at least four days prior to the transit study.

Defecation dynamics

In all children anorectal manometry was performed to evaluate the external anal sphincter (EAS) function in relation to defecation, using a water perfused system and EMG with surface electrodes.[14] In children with faecal retention, disimpaction with enemas was performed daily during the week prior to manometry to ensure that the rectal ampulla was free of faecal material.

While lying in the left lateral position, the child was asked to bear down five times as if defecating. Defecation dynamics were considered normal if the manometric profile and the integrated EMG of the EAS showed a decrease or no change during expulsion of the balloon in at least two of five defecation attempts.[14] Defecation dynamics were defined as abnormal if manometric and myoelectrical increase occurred during bearing down in at least four out of the five defecation attempts.

Statistical methods

Results were expressed using the median and the range for continuous variables and percentages for discrete variables. Groups were compared using the Wilcoxon signed rank test for continuous variables and the χ^2 test for discrete variables. For all tests a level of 0.05 was used for significance.

RESULTS

Of the 223 patients divided into children with PC, FNRFS, or RAP respectively, 215 were eligible. Five patients were unable to swallow the capsule with radio-opaque markers and in three children, the parents were not able to understand and complete the child behaviour checklist, due to language difficulties. Table 1 shows baseline characteristics of study groups. A male predominance was found in the PC and FNRFS group. The number of bowel movements in PC children was significantly lower compared to the other two groups ($p<0.01$).

Child behaviour checklist

Total behaviour problem score

Of the children with FNRFS, 39% had scores in the clinical range. Children with PC and RAP had scores above the 90th centile in 37% and 17% of the cases, respectively. However, no significant differences in the mean T scores were found among the three patient groups. Children with PC and FNRFS had significantly more behaviour problems than the Dutch normative sample. The total behaviour problem score in children with RAP was within the normal range.

Children with FNRFS and PC both had significantly more externalising problems compared to the Dutch normative sample. Children with RAP were within the normal range. No significant differences in externalising problems were found between the three groups.

Children with PC, FNRFS, and RAP scored significantly higher on internalising problems compared to the Dutch norm: 38%, 38%, and 29% of the patients had scores within the clinical range, respectively.

Domains

A considerable number of patients in all three groups scored within the clinical range with respect to somatic problems (RAP, 71%; PC, 44%; FNRFS, 28%). The somatic domain includes the following items: being constipated, feeling overtired, having pains, headaches, nausea, stomach aches, and vomiting.

A significant difference in social problems was found between the children with FNRFS (25% scores above the 90th centile) and those with RAP (0%). Of the children with PC, 16% had scores above the 90th centile in the social domain, which was not significantly different from the other two groups.

Colonic transit time

Normal total CTT (<62 hours) was found in respectively 56%, 91%, and 92% of the children with PC, FNRFS, and RAP. Table 2 summarises the different segmental and CTT values in the three separate groups. In children with PC both segmental and total CTT were significantly prolonged compared to the other two groups (PC compared to FNRFS, and PC versus RAP). In patients with FNRFS patients, the rectosigmoid transit time was significantly delayed compared to children with RAP, which resulted in a significantly longer total CTT. The vast majority of children with RAP had normal total and segmental CTT.

Behavioural profiles of children with PC, FNRFS, and RAP who had normal or delayed CTT were not statistically different.

Defecation dynamics

In 55%, 48%, and 42% of the children with PC, FNRFS, and RAP, respectively, an abnormal contraction of the external anal sphincter, instead of relaxation, during attempted defecation was seen on anorectal manometry.

Table 1 Baseline characteristics of study groups

	PC (n = 135)	FNRFS (n = 56)	RAP (n = 24)
Boys	88 (65%)	46 (82%)	10 (42%)
Age (y)	8 (5–14)	9 (5–17)	9 (5–16)
Civil status parents			
Married	113 (84%)	47 (84%)	22 (92%)
Divorced	5 (4%)	4 (7%)	0 (0%)
School			
Not in school	1 (1%)	0 (0%)	1 (4%)
Special education	12 (8%)	5 (11%)	2 (8%)
Elementary school	107 (79%)	36 (64%)	16 (68%)
Low professional school	5 (4%)	2 (3%)	1 (4%)
High school	9 (7%)	11 (19%)	4 (16%)
Others	1 (1%)	2 (3%)	0 (0%)
Clinical features			
Family history of constipation	51 (38%)	16 (29%)	11 (46%)
Bowel movements/week	2 (0–14)*	7 (3–21)	7 (2–21)
Large amount of stools	80 (59%)*	0 (0%)	1 (4%)
Encopresis	117 (87%)	56 (100%)	0 (0%)
Palpable abdominal mass	45 (34%)*	0 (0%)	1 (4%)
Palpable rectal mass	37 (28%)*	0 (0%)	0 (0%)
Abdominal pain	69 (51%)†	22 (39%)	24 (100%)

*Significant difference ($p<0.01$) between the children with PC and the other two groups.
†Significant difference ($p=0.02$) between the children with PC and FNRFS.

No significant differences in mean T scores on TBP, externalising and internalising subscales, and various domains could be recognised between children able and unable to relax their external anal sphincter during defecation attempts.

DISCUSSION

The role of psychological and emotional components in the aetiology of defecation disorders, including constipation, FNRFS, and recurrent abdominal pain, remains a matter of debate. Some will argue that emotional problems are the result of defecation disorders, others believe that they play an important role in the aetiology.

In this study, using a validated child behaviour checklist, mild behavioural abnormalities were found in patients with PC and FNRFS. In contrast, children with RAP showed no significant overall behavioural abnormalities compared to the normative controls. Interestingly, children with RAP scored high in the somatic domain. No correlation was found between behavioural profiles and specific colonic transit time patterns or abnormal defecation dynamics in any of the patient groups.

Using the child behaviour checklist, children with PC and FNRFS showed a higher incidence (40%) of behavioural problems, compared to the Dutch normative data. Earlier studies in constipated and encopretic children showed similar results on behaviour problem scores.[6 15–17] This relatively high percentage of behavioural problems might be a reflection of the major impact that defecation disorders have on the normal development of children. The question whether defecation problems result in defecation disorders or vice versa is a major point of issue and difficult to answer. In a recent study it was shown that successful treatment of defecation disorders in children normalised CBCL scores in the majority of patients. Only in a minority of these children referral to a mental health professional was needed.[18] The role of encopresis, therefore has to be interpreted as the important factor in the occurrence and maintenance of the behavioural problems in children with defecation disorders.

It has been suggested that RAP may commonly occur due to psychogenic factors.[8] In this study significantly higher internalising behaviour was found in RAP children compared to the normative sample. However, this was mainly due to very high scores on somatic complaints. No difference was found in overall behaviour. Two other studies showed even higher scores on internalising behaviour in RAP children.[3 19] PC and FNRFS patients could not be described as having either typically internalising or externalising personalities. These findings are in accordance with earlier findings by Gabel *et al* using the CBCL.[6]

Although 40% of these children score within the clinical range, children with PC and FNRFS can be characterised as only having mild psychiatric problems, suggesting that these children should primarily be treated in a paediatric setting and not in a psychiatric outpatient clinic. This is supported by earlier results showing that T scores of successfully treated children with encopresis decreased significantly and returned within the normal range.[18] Therefore, the treatment of defecation disorders should be primarily performed in a paediatric setting and should consist of a combination of laxatives and a behaviour modification programme aimed at promoting regular toileting.[16]

In the present study, no specific profile on CBCL could be identified when the children were divided into those with

Table 2 Colonic transit times in hours; mean (range)

	PC (n = 135)	FNRFS (n = 56)	RAP (n = 24)	Normal range§ (n = 23)
Right colon	13.3 (0–63.6)*	7.8 (0–26.4)	6.8 (0–21.6)	7.7 (18)
Left colon	15.8 (0–110.4)*	6.7 (0–19.2)	6.6 (0–25.2)	8.7 (20)
Rectosigmoid	45.5 (0–226.8)*	26.7 (4.8–93.6)†	18.8 (0–49.2)	12.4 (34)
Total colon	74.8 (0–380.4)*	41.1 (10.8–104.4)‡	31.0 (0–69.6)	29.0 (62)

*Significant difference ($p<0.01$) between the PC and FNRFS, and between PC and RAP.
†Significant difference ($p=0.03$) between the FNRFS and RAP group.
‡Significant difference ($p=0.01$) between the FNRFS and RAP group.
§Arhan *et al*.[13]

normal, delayed, or slow colonic transit times. In contrast in adults with constipation and a normal colonic transit time significantly more symptoms of psychological distress were found than patients with constipation of the slow transit type.[20] An important difference between adults and children with constipation lies in the absence of encopresis or soiling complaints in adults. We suggest that this agonising characteristic is primarily responsible for the high scores on the CBCL.

All study patients were referred to our paediatric motility unit to receive biofeedback training for their complaints. Prior to these sessions anorectal manometry was performed in all three patient groups. Clearly, anorectal manometry has no place in the diagnostic work up in children with recurrent abdominal pain. Total behaviour scores were not different for children with normal or abnormal defecation dynamics. These findings are in accordance with the study of Loening-Baucke *et al*, which also failed to show differences in behaviour profiles between children able or unable to defecate balloons.[15]

In conclusion, patients with defecation disorders have more behavioural problems than the normative sample. Since these behaviour problems are mild and disappear after adequate treatment, patients should be treated in a paediatric setting. Referral to a mental health service might be useful in patients with social withdrawal, a low self esteem, and depressive behaviour due to their defecation disorder.

Manometric or colonic transit patterns do not correlate with behavioural problems.

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CORRECTION

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