Accident-related neurogenic fecal incontinence: a retrospective study

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Abstract

Abstract Background To evaluate the anorectal motility characteristics, the quality of life and psychological health of accident-related neurogenic fecal incontinence(ArNFI) patients. **Methods** A retrospective study was conducted on 26 patients with ArNFI visiting the gastrointestinal motility center of affiliated provincial hospital of Anhui medical university were collected as research objects from January 2016 to August 2019. The anorectal motility characteristics of these patients were recorded and analysed by high resolution manometry (HRM), 10 healthy subjects for the same period were recruited as the control group. The psychological characteristics of these patients and healthy subjects were compared by HAMA and HAMD scores, and their quality of life was investigated by SF36. **Results** Anal sphincter resting pressure in the ArNFI group was more lower than that of the control group (21.18 ± 4.68 vs 34.83 ± 14.13 , $P < 0.05$). Anorectal compliance in the ArNFI group was more lower than that of the control (1.41 ± 0.32 vs 4.03 ± 1.06 , $P < 0.05$). Maximal squeeze pressure were in the ArNFI group was also lower than that of the control (53.66 ± 14.59 vs 143.95 ± 19.82 , $P < 0.05$). HAMA, HAMD scores of the ArNFI group in the ArNFI group were all higher than that of the control (21.29 ± 2.06 vs 7.63 ± 1.41 ; 22.00 ± 3.70 vs 8.75 ± 1.91 , respectively, all $P < 0.01$). There were significant differences between SF36 scores of ArNFI group and the control group in the 8 dimensions of PF, RP, GH, VT, SF, RE and MH. ($P < 0.01$). **Conclusion** In patients with ArNFI, there were significantly reduced anorectal motility characteristics, increased HAMA, HAMD scores, and their life quality was obviously declined.

Background

Fecal incontinence(FI) refers to outflowing of intestinal contents beyond patients control repeatedly, resulting from overflow, reduced storage capacity, disruption of external anal sphincter or puborectalis muscle, weakness of internal anal sphincter and decreased perception of rectal sensation. FI can be divided into passive fecal incontinence (the patient's feces leaked out unconsciously), urgent fecal incontinence (the patient's feces leaked out consciously but uncontrollably) and fecal leakage (the patient's feces leaked out after a normal defecation).[1] The prevalence of FI in the general population is 1.0% ~ 7.4%.[2] According to the cause of FI, it can be divided into neurogenic fecal incontinence and myogenic fecal incontinence. Neurogenic fecal incontinence(NFI) is relatively common in clinical and it is the important type of fecal incontinence. It seriously reduces the quality of life and affects the mental healthy of patients because the patients with NFI can not control the time, frequency and degree of defecation.[3]

Accident-related neurogenic fecal incontinence(ArNFI) refers to the injury of the brain, brainstem and nervous system above the sacral ganglion caused by accidents, leading to the disorder of defecation emptying and anal self-control, which is one of the common type of NFI.[4] Studies have shown that NFI is associated with congenital anomalies, pelvic floor neuropathy, central diseases, and systemic diseases, but its anorectal motility characteristics have not still been well elucidated.[4,5] High resolution manometry (HRM) can show the motility changes of anus, rectum and abdominal accurately, which is an effective method for ArNFI diagnosis and evaluation.[6]

Therefore, the aim of our study was to explore the anorectal dynamic characteristics, psychological characteristics, and quality of life of ArNFI patients.

Methods

1.1 Objects

Inclusion criteria were as follows[7]: central nervous system damage caused by a definite accident; non-controlled stool leakage occurred after the accident, but not before; the frequency of stool leakage meets at least two times within 4 weeks; anorectal manometry showed obvious abnormality.

Exclusion criteria were as follows: severe heart and lung diseases, diabetes, nephropathy and other chronic diseases associated with neuropathy or acute intestinal infection or obstruction etc. 26 patients with ArNFI were conducted HRM in gastrointestinal motility center of affiliated provincial hospital of Anhui medical university were collected as research objects from January 2016 to August 2019, Meanwhile, 10 healthy subjects were selected and analysed as control group.

1.2 Measurements

1.2.1 Anorectal High Resolution Manometry (HRM)

All enrolled patients and healthy subjects underwent the HRM test(GAP-24A type, MedKinetic, Ningbo, China). Patients were instructed to prohibit drugs affecting gastrointestinal motility for 1 week and fasting for 4 to 6 hours before examination. Patients were [conformed to defaecate](#) all urine and faeces as far as possible, and take the left knee bending position. The catheter was placed horizontally at the level of the patient's anus and cleared. The catheter was inserted into the position of 7.5cm. The proximal end was placed in the anal sphincter and the distal end was placed in the rectum. The following tests were conducted: 1) Relaxation test: patients were instructed to relax and breathe calmly for 10 seconds; 2) Contraction test: patients were instructed to contract the anus continuously for 30s; 3) Defecation test: patients were instructed to perform defecation movements continuously for 30s; 4) Sensory test: inflate the balloon slowly to ask patients about their feelings, including initial sensation threshold, initial desire of defecation threshold, strong desire of defecation threshold and maximum tolerated dose. Medview360 pressure analysis software was used to analyze the characteristics of patients' anorectal motility.[8]

1.2.2 Assessment of mental state

HAMA (Hamilton anxiety scale) and HAMD (Hamilton depression scale)[9] were both used to reflect the mental state of these patients, and were independently scored by two trained evaluators by conversation and examination. HAMA contains a total of 14 items and HAMD contains a total of 24 items, all of which adopt the 5-grade scoring method of 0~4 points, and the standards of all levels are: 0(asymptomatic), 1(mild), 2(moderate), 3(severe) and 4(extremely severe).

1.2.3 Survey of quality of life

SF-36 scale[10] was used to investigate the quality of life of patients, which includes 8 dimensions: physical health function (PF), physical role function (RP), physical pain (BP), general health status (GH), vitality (VT), social function (SF), emotional role (RE) and mental health (MH). Each dimension was converted into final score (0 ~ 100 points) according to the formula. The higher the score, the better the patient's quality of life.

1.3 Statistical analysis

EpiData 3.1 software was used to input data and SPSS21.0 software was used for statistical analysis. The normal distribution data is expressed as mean $\pm$ standard deviation; The data with non-normal distribution were represented by the median, range and the *t*-test was used for comparison between the two groups with normal distribution. Wilcoxon rank sum test was used to compare the two groups with non-normal distribution. Counting data and classification variables were analyzed by χ^2 test. The difference was statistically significant with $P < 0.05$.

Results

2.1 Study Population

Among the 26 ArNFI patients, the age range is 30~77 years old, and the average age is (47.18 $\pm$ 15.40) years old, which include 12 males and 14 females. There were 13 car accidents, 10 accidental falls, and 3 surgical spinal cord injury. There were no significant differences in age, sex and BMI between the ArNFI group and control group. See table 1.

2.2 Analysis of anorectal motility characteristics

2.2.1 Anorectal pressure characteristics

Anal sphincter resting pressure in the ArNFI group and the control group was 21.18 $\pm$ 4.68~34.83 $\pm$ 14.13, respectively, and the difference between the two groups was statistically significant $P < 0.05$. Anorectal compliance was 11.41 $\pm$ 0.32~4.03 $\pm$ 1.06, respectively, and the difference between the two groups was statistically significant $P < 0.05$. Maximal squeeze pressure were 53.66 $\pm$ 14.59~143.95 $\pm$ 19.82, respectively, the difference between two groups was statistically significant ($P < 0.05$); There was no statistically significant difference in the rectum resting pressure, anal sphincter length, effective length of anal sphincter, minimum volume of induced RAIR, rectum and anal pressure gradient ($P > 0.05$) between the two groups . See table 2.

2.2.2 Balloon inflation characteristics

In the ArNFI group, 10 cases of initial sensory threshold were not extracted, and 16 cases of the value was 85.45 $\pm$ 36.83 ml. The initial desire of defecation threshold was not extracted in 18 cases, and the value was 128.25 $\pm$ 59.84 ml in 8 cases. The strong desire of defecation threshold was not extracted in 18 cases,

and the value of 8 cases was 190.33 ± 58.79 ml. The maximum tolerated dose was not extracted in 18 cases, and the value was 250.50 ± 28.41 ml in 8 cases. See table 3.

2.2.3 Contradictory contraction and cough reflex

There were 10 and 0 cases of contradictory contraction between the ArNFI group and the control group respectively, and there was no statistically significant difference between the two groups ($\chi^2 = 5.325$, $P = 0.021 < 0.05$). The number of cases with cough reflex in ArNFI group and control group was 18 and 10, respectively, and the difference between the two groups was statistically significant ($\chi^2 = 3.956$, $P = 0.047 < 0.05$). See figure 1.

2.2.4 Anorectal manometry image

In the resting state of the ArNFI group, the color band of anorectal pressure is light green, indicating that the anal sphincter resting pressure is low, as shown in figure A. In the state of contraction, the color band of anal pressure in the patient changed from light green to dark green, and the color band of pressure in the abdomen changed from dark blue to light green, indicating that the patient had low anal contraction force and needed to complete anal contraction with the help of abdominal pressure, as shown in figure B. In the state of defecation, the dark blue color bands in the abdomen of the patient changed from dark blue to dark green, while the color bands in the anal changed from light green to dark green, indicating that the patient had contradictory contractions, which may be a compensatory pressure increase in the anal to avoid the occurrence of incontinence, as shown in figure C.

2.3 Psychological characteristics

HAMA scores of the ArNFI group and the control group were 21.29 ± 2.06 and 7.63 ± 1.41 respectively, the difference between the two groups were statistically significant ($t = 14.54$, $P < 0.001$). HAMD scores were 22.00 ± 3.70 and 8.75 ± 1.91 , respectively, the difference between the two groups were statistically significant ($t = 11.63$, $P < 0.001$). See figure 2.

2.4 Life quality characteristics

SF-36 scale was used to investigate the quality of life of patients and it was found that there were significant differences between ArNFI group and the control group in the 8 dimensions of PF, RP, GH, VT, SF, RE and MH. As shown in table 4.

Discussion

In this study, we found that ArNFI patients had significantly abnormal anorectal motility characteristics, increased HAMA.HAMD scores, and their life quality was obviously declined. The abnormal anorectal motility is believed to be attributed to the declined life quality and the accompanied anxiety and depressive symptoms.

Effective defecation control requires the following conditions[11]: 1)the anal sphincter can maintain a certain pressure in the resting state; 2)the anal and rectum have a good sensory function and can cause the corresponding contraction or inhibition of the anal sphincter after receiving relevant stimulation; 3)the rectal wall has good compliance and storage capacity. Anorectal manometry is a important method to evaluate anorectal function.[12] Anorectal manometry in patients with FI is characterized by decreased anal resting pressure and maximum squeeze pressure, impaired rectal sensory function and the ability of anal canal dentate line to distinguish intestinal contents, abnormal RAIR or abnormal minimum volume of induced RAIR.[13] Decreased rectal compliance can lead to increased frequency of defecation and a sense of urgency due to decreased rectal fecal storage function so that FI can occur even if the anal sphincter function is normal.[14]

The clinicopathological changes of NFI patients mainly include autonomic control and contractile function of puborectalis and external sphincter decrease, colon motility and the tension of internal anal sphincter is relatively elevated after the injury of the nervous system.[4.5] The expansion sensory loss of rectal mucosa can not cause desire of defecation or defecation action. Running under the state of excessive expansion consistently can lead to anal sphincter expansion relaxation, shown as "overflowing": 1) large amount of fecal mass deposition in the rectum and anal canal; 2) anal relaxation; 3) some patients with intestinal fluid discharge and even rectocele and so on.[15] Clinical treatment is mainly aimed at improving nervous system function.

FI seriously affects the quality of life of patients. Studies have shown that Wexner score is correlated with the quality of life of FI patients. When Wexner score ≥ 9 , patients' quality of life is severely damaged, and their community activities are limited and the scope of activities is limited to their home.[16.17.18] Our study also shown the the life quality of ArNFI patients was significantly lower in PF,RPB,PGH,VT,SF,RE and MH than that of the control group which was consistent with the previous studies[16.17.18]. Meanwhile, the HAMA,HAMD scores of ArNFI patients were significantly lower than those of the control group which were similar to the previous study .[19.20]

Currently, no drug is effective for NFI, and the goal of drug therapy is to reduce defecation frequency and improve feces propertie.[21.22] A meta-analysis included 16 randomized controlled study shown that application of loperamide or phenylethyl piperidine plus atropine can reduce the sense of defecation urgency and FI, help faeces forming, reduce the use of sanitary pad compared with placebo, but there were no significant differences of the anorectal physical examination before and after treatment. Compared with phenylethyl piperidine, loperamide is more effective, less adverse reaction of the central nervous system.[23] Biofeedback therapy is recommended if anal-rectal manometry shows that the weakness of the external anal sphincter in patients with FI or decreased rectal sensory function due to nerve injury.[24.25] Biofeedback is a painless and noninvasive cognitive training of pelvic floor and abdominal wall muscles, especially in patients with complete anal sphincter and reduced rectal sensory function. However, biofeedback treatment is ineffective for FI patients caused by isolated internal sphincter weakness, behavioral or psychiatric disorders, part of neurogenic, rectal resection, inflammation or stenosis, and obvious anal sphincter structural damage.[26] The success rate of biofeedback treatment

is 38%~100%.[27] Neuromodulation is also an effective treatment. Many reports have shown that sacral nerve stimulation can improve the symptoms of FI. Compared with percutaneous tibial nerve stimulation, sacral nerve stimulation can significantly improve functional outcomes and quality of life in NFI patients and no serious adverse events were found so far.[28.29.30]

In recent years, only a few studies of NFI have been published on Pubmed, and most of these studies are related to congenital deformity in children.[31.32] In addition, few report of NFI caused by accidents. There are some shortcomings in these study: ❶. Currently, diagnostic criteria of ArNFI are still lacking, and relevant literatures have not provided strict diagnostic criteria for ArNFI. ❷. With a small sample size, the large-scale and multi-center research is expected to be applied in this project. We think the diagnosis of ArNFI should be related to the following points: 1) There are definite accidents that cause central nervous system damage, such as crash, falls, surgery, etc. 2) There is a specific time node and FI occurred after the accident, but not before; 3) Have a long course of illness and meet the diagnosis of FI.

Conclusions

In summary ,this study shown significantly abnormal anorectal motility characteristics, increased anxiety and depressive symptoms,and obviously declined life quality in patients with ArNFI. Further research is necessary to better understand the anorectal motility characteristics,the clinical characteristics and the natural history of ArNFI patients. Exploration of the diferent therapeutic modalities for ArNFI is crucial to standardise its management.[33]

Abbreviations

FI Fecal incontinence

NFI Neurogenic fecal incontinence

ArNFI Accident-related neurogenic fecal incontinence

BMI Body Mass Index

HRM High resolution manometry

HAMA Hamilton anxiety scale

HAMD Hamilton depression scale

SF-36 The Medical Outcomes Study item short from health survey

PF Physical health function

RP Physical role function

BP Physical pain

GH General health status

VT Vitality

SF Social function

RE Emotional role

MH Mental health

RAIR Rectal anal inhibitory reflex

Declarations

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Competing interests: The authors declare that they have no competing interests.

Consent for publication: Not applicable.

Ethics approval and consent to participate: The protocol was approved by Ethics Committee of Anhui Provincial Hospital Dated June 15th 2015, and all patients joined the study with written informed consent for research use of their survey data. The guidelines of Helsinki Declaration were followed.

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Tables

Table 1. Demographics for the 2 study groups

Variables	Healthy controls (n=10)	ArNFI(n=26)	P-value
Age(media,range)/years	31(27-64)	35(30-77)	0.466
Sex(male,%)	5(50.0%)	12(46.2%)	0.497
Body mass index (media,range)	24(17-34)	22(18-35)	0.097
Course of disease (media,range)/years	/	6(3-9)	/

ArNFI:Accident-related neurogenic fecal incontinence

Table 2. The comparisons of anorectal pressure characteristics for the 2 study groups

Variables	Healthy controls (n=10)	ArNFI(n=26)	t-value	P-value
anal sphincter resting pressure(mmHg)	34.83± 14.13	21.18± 4.68	2.943	0.011
rectal resting pressure(mmHg)	19.81± 8.49	20.73± 4.31	0.170	0.868
anal sphincter length(cm)	3.16±0.61	3.33± 0.89	0.418	0.683
the effective length of anal sphincter(cm)	2.23± 0.64	1.56± 0.67	1.950	0.073
rectal compliance(cc/mmHg)	4.03± 1.06	1.41± 0.32	3.929	0.002
minimum volume of induced RAIR(ml)	21.25± 6.21	14.29± 5.34	0.877	0.396
rectal-anal pressure gradient(mmHg)	-21.70± 6.38	-19.65± 4.98	0.150	0.883
maximal squeeze pressure(mmHg)	143.95± 19.82	53.66± 14.59	3.234	0.007

ArNFI:Accident-related neurogenic fecal incontinence; RAIR: rectal anal inhibitory reflex

Table 3.The comparisons of balloon inflation characteristics for the 2 study groups

Variables	Healthy controls (n=10)	ArNFI(n=26)	
	$\pm$ s(ml)	extracted $\pm$ s(ml)	not extracted [n,%]
initial sensation threshold	36.63 $\pm$ 17.93	85.45 $\pm$ 36.83	10,38.5%
initial desire of defecation threshold	87.50 $\pm$ 42.64	128.25 $\pm$ 59.84	18,69.2%
strong desire of defecation threshold	158.75 $\pm$ 74.23	190.33 $\pm$ 58.79	18,69.2%
maximum tolerated dose	220.00 $\pm$ 84.41	250.50 $\pm$ 28.41	18,69.2%

ArNFI:Accident-related neurogenic fecal incontinence

Table 4.The comparisons of life quality scores(SF-36) for the 2 study groups

Variables	Physicl functioning	Role- physical	Bodily Pain	General healthy	Vitality	Socail functioning	Role emotional	Mental Healthy
Healthy controls (n=10)	1.78 $\pm$ 0.99	1.64 $\pm$ 1.18	1.75 $\pm$ 0.89	2.15 $\pm$ 1.17	1.67 $\pm$ 1.03	1.54 $\pm$ 0.94	2.27 $\pm$ 0.94	1.83 $\pm$ 0.706
ArNFI [n=26]	0.71 $\pm$ 0.86	0.62 $\pm$ 0.79	0.92 $\pm$ 0.85	0.77 $\pm$ 0.89	0.66 $\pm$ 0.82	0.64 $\pm$ 0.81	1.58 $\pm$ 0.82	0.84 $\pm$ 0.600
<i>t</i> -value	14.535	14.407	11.631	17.699	14.272	12.984	9.636	18.729
<i>P</i> -value	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

ArNFI:Accident-related neurogenic fecal incontinence

Figures

Figure 1

Figure 1

Figure 2

Figure 2

Figure 3

Figure A

Figure 4

Figure B

Figure 5

Figure C

Supplementary Files

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