Anal function in geriatric patients with faecal incontinence

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SUMMARY The association of faecal incontinence with constipation and confusion in the elderly is well recognised but the anal function of faecally incontinent geriatric patients is poorly understood. Anal studies were therefore performed on 99 geriatric patients (49 with faecal incontinence, 19 continent patients with faecal impaction and 31 geriatric control patients with normal bowel habit) and 57 younger healthy control patients. An age related reduction in anal squeeze pressure but not resting pressure was identified. A reduction in anal resting pressure was detected in the faecally incontinent geriatric patients but squeeze pressure did not differ significantly from that found in the other geriatric patients. Anal sensation was impaired in the faecally incontinent patients. No difference was found between the groups as measured by pudendal nerve terminal motor latency. Gross neuropathy of the distal part of the pudendal nerve does not account for the observed external anal sphincter weakness in geriatric patients or for their faecal incontinence. Internal anal sphincter dysfunction is an important factor in faecal incontinence in the elderly.

Faecal incontinence is an unpleasant problem which affects up to 1% of over 65's in the population.^{1,2} It is most prevalent among the institutionalised elderly. Approximately 10% of those in residential homes^{3,4} and 30% of patients in geriatric continuing care wards are incontinent of faeces at least once per week.^{4,5}

Many younger patients, mainly women,⁶ also suffer with faecal incontinence. There are now many reports of external anal sphincter and pelvic floor muscle weakness in these patients with idiopathic faecal incontinence.⁷⁻¹⁴

Denervation of the external sphincter and puborectalis muscles has been shown in these younger patients by concentric needle^{15,16} and single fibre electromyographic (EMG) studies.¹⁰⁻¹⁴ It has been proposed that idiopathic faecal incontinence is the result of damage to the nerve supply of these muscles¹⁷ as there is pudendal neuropathy in these

patients^{13,14,18} which is associated with either difficult childbirth, especially forceps delivery,^{6,19,20} or chronic straining at stool.^{21,22} Impaired anal sensation is also recognised in these patients.²³⁻²⁵

Read and Abouzekry²⁶ have proposed that age related anal sphincter weakness and some degree of pudendal neuropathy may account for the high incidence of faecal incontinence in the elderly. In support of this they quoted a study by Percy *et al*²⁷ where external anal sphincter single fibre EMG was carried out on six faecally incontinent geriatric patients and four continent geriatric patients. External sphincter fibre density is known to increase with age.²⁸ Percy *et al* thought that the fibre density was higher in their incontinent geriatric patients but the small number of patients studied did not allow any valid comparison to be made between the two groups.

The pathophysiology of idiopathic faecal incontinence is now better understood but as previous studies have not included geriatric patients conclusions drawn do not necessarily apply to them. The follow-

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ing study was undertaken to assess the anal function of faecally incontinent geriatric patients.

Methods

PATIENTS

Anal studies were carried out on 99 patients recruited from the Geriatric Unit, University Hospital of South Manchester. They were either inpatients or attended the Day Hospital for outpatient treatment. Forty nine of these patients were classified as faecally incontinent defined as the involuntary expulsion of faeces occurring at least once per week in the previous month. The frequency of these incontinent episodes ranged from one per week to six per day (median 6.8 per week). Nineteen patients with faecal impaction without faecal incontinence were also studied. Digital rectal examination was used to detect the presence of faecal impaction which was defined as rectal loading with a large amount of faeces of any consistency. Thirty one geriatric patients with normal bowel habit and 57 patients from the Surgical Unit, University Hospital of South Manchester were studied as controls.

The surgical control patients were all in good general health and were able to walk unaided. The geriatric patients all had multiple medical problems and most had impaired mobility.

ETHICAL APPROVAL

This study was approved by the Ethical Committee of the South Manchester Health Authority in April 1986, and informed written consent was obtained for all patients studied. Consent for studies on confused patients was provided by the patients next of kin.

CLINICAL DETAILS

Clinical details and physical examination findings were recorded for each patient. Mobility was assessed and classified into one of four groups. The abbreviated mental status questionnaire validated by Quereshi and Hodkinson²⁹ was used to screen for dementia. In the absence of dysphasia a score of 7/10 or less on two or more occasions was considered to indicate dementia.

Each patient was studied lying in the left lateral position. No bowel preparation was given though each patient was given the opportunity to use the toilet before the examination.

ANAL MANOMETRY

Anal pressures were measured at 1 cm stations using a water filled microballoon catheter system (external diameter 4 mm) connected *via* a transducer to a Devices chart recorder. At each station one to two minutes were allowed to elapse to allow anal pressure

to reach a steady state. This steady state pressure was recorded as the resting pressure for that station. Patients were then asked to squeeze the anal canal tightly shut for five to 10 seconds. They were observed during this procedure to ensure compliance. The maximum anal resting pressure and anal squeeze pressure above resting pressure were recorded for subsequent analysis.

RECTOANAL REFLEX

This reflex was examined by distending the rectum whilst recording anal resting pressure at the site at which resting pressure was highest. A party balloon (from W H Smiths) tied to the end of a length of stiff polyvinyl tubing and connected to a 50 ml syringe through a three way tap was used to distend the rectum. Fifty millilitre boluses of air were injected into the rectal balloon over a period of six to eight seconds. The anal sphincter pressure trace was simultaneously monitored for the presence or absence of the two components of the rectoanal reflex: inflation reflex – an early rise in pressure caused by external sphincter contraction;^{30,31} inhibitory reflex caused by internal and external anal sphincter relaxation.

The reflexes were considered to be present if a pressure change of more than 15 cm H₂O was recorded. No attempt was made to elicit the inhibitory reflex in patients with very low resting pressure – that is, <30 cm H₂O as further inhibition of resting pressure was considered unlikely.

PUDENDAL NERVE TERMINAL MOTOR LATENCY

Pudendal nerve terminal motor latency (PNTML) was measured using the method previously described by Kiff and Swash.¹³ The nerve stimulator of a Medelec MS91 EMG machine was used with a transrectal stimulating/recording device to stimulate the pudendal nerve. Single square wave stimuli of 0.1 ms duration once per second not exceeding 50 V in intensity were used. The evoked external sphincter response was displayed and recorded on the MS91. The latency (PNTML) was defined as the time from the onset of the stimulus to the onset of the response. Measurements were made from the right and left pudendal nerves.

ANAL SENSATION

Anal sensation was assessed by asking patients to discriminate between water (37°C) and air infused into the anal canal through the side opening of a polyvinyl catheter inserted into the anal canal using the method described by Read and Read.³²

STATISTICAL ANALYSIS

Categorical variables were compared for the four patient groups using Yates's corrected contingency

table (χ^2) analyses or Fisher exact tests as appropriate.

Continuous variables were examined using a one-way analysis of variance or Student's *t* test as required. Each variable was tested for statistical normality. Where this could reasonably be assumed, the data were analysed untransformed. Otherwise a normalising transformation – for example, logarithmic or square root, was sought. If all else failed an appropriate non-parametric test (Kruskal-Wallis or Mann-Whitney) was used. Where necessary, significant effects revealed by the analyses of variance were investigated using a multiple comparison test based on the technique of Tukey. Correlations between continuous variables were measured using the Pearson coefficient if both variables were normally distributed and by the Spearman coefficient otherwise.

Statistical significance was set at the conventional 5% level. The calculations were performed using the Statistical Package for the Social Sciences as implemented at the University of Manchester Regional Computer Centre.³³

Results

PATIENTS

The three groups of geriatric patients were well matched for age and sex with a 2:1 female:male ratio (Table 1). There was a slight male bias among the surgical patients who were also significantly younger than the geriatric patients (Tukey multiple comparison test, $p<0.05$) (Table 1).

The mental status scores of the faecally incontinent patients were significantly lower than those of the other patients studied (Kruskal Wallis one way analysis of variance, $p<0.001$). The incidence of dementia was significantly higher among the faecally incontinent patients (59%). Thirty four (69%) of the faecally incontinent patients were impacted. The incontinent patients were significantly less mobile than the other groups of patients (corrected $\chi^2=141.6$, $df=9$, $p<0.001$) (Table 1).

ANORECTAL MANOMETRY

The effect of age on the anal pressures was determined in the control patients after excluding patients with neurological disease, dementia and/or diabetes mellitus. No correlation was found between age and resting pressure (Pearsons correlation coefficient $r=0.03$, $n=57$, $p=0.83$) but there was a significant reduction in anal squeeze pressure with age (Pearsons correlation coefficient $r=-0.46$, $n=56$, $p=0.001$).

Resting pressure was significantly lower in the incontinent patients than in the other groups of

Table 1 Comparison of the characteristics of the geriatric and surgical patients studied

	Geriatric patients			Surgical controls
	Faecal incontinence	Faecal impaction	Controls	
n	49	19	31	57
Female	31 (63%)	12 (63%)	22 (71%)	23 (40%)
Mean age (yr)	80	76	77	48
95% CI	78–83	72–80	74–79	43–52
Faecal impaction	34 (69%)	19 (100%)	0	0
Urinary incontinence	41 (84%)	9 (47%)	5 (16%)	0
Dementia	26 (59%)	6 (33%)	5 (16%)	0
Mental status score (median)	4.5	9.7	9.8	10
Other neurological disease – for example, stroke	21 (43%)	10 (53%)	11 (36%)	0
Diabetics	2 (4%)	3 (16%)	6 (19%)	0
Mobility				
Walks without walking aid or assistance	9 (18%)	3 (16%)	6 (19%)	57 (100%)
Walks with walking stick	4 (8%)	5 (26%)	14 (45%)	0
Walks with walking frame	5 (10%)	6 (32%)	7 (23%)	0
Immobile	31 (64%)	5 (26%)	4 (13%)	0

Table 2 Anal manometry and pudendal nerve terminal motor latency results

	Geriatric patients			Surgical controls
	Faecal incontinence	Faecal impaction	Controls	
Anal manometry (n)	43	18	27	42
Resting pressure				
Mean (cm H ₂ O)	55	84	74	71
95% CI	47–64	69–99	63–86	63–79
Squeeze pressure				
Mean (cm H ₂ O)	37	44	51	167
95% CI	25–49	29–58	36–65	138–195
PNTML (ms) (n)	34	17	21	43
Right	2.0	2.2	2.0	2.1
Left	2.0	2.1	2.1	2.0
Mean	2.0	2.2	2.1	2.0
95% CI	1.9–2.2	2.1–2.3	1.9–2.2	1.9–2.1

patients studied (Tukey multiple comparison test, $p<0.05$) (Table 2). No difference was found in resting pressure between the impacted geriatric patients (continent or incontinent) ($n=48$, mean 67 cm H₂O) and the geriatric patients without faecal impaction ($n=40$, 67 cm H₂O) (Student's *t* test, $t=0.06$, $df=86$, $p=0.95$).

Anal squeeze pressure was significantly lower in the geriatric patients than in the surgical patients

Table 3 Mobility and anal sphincter pressures

Mobility	Walks unaided	Walks with stick	Walks with frame	Immobile
(n)	18	22	16	37
Anal resting pressure				
Mean	76	78	68	59
95% CI	59-92	64-92	54-82	49-69
Anal squeeze pressure				
Mean	89	56	56	32
95% CI	40-138	38-75	34-78	22-42

Table 4 Rectoanal reflex and anal sensation results in geriatric patients

	Geriatric patients		Controls
	Faecal incontinence	Faecal impaction	
Rectoanal reflex			
Inflation reflex (n)	36	18	27
Reflex present	22 (61%)	9 (50%)	11 (41%)
Inhibitory reflex (n)	32	18	27
Reflex present	17 (53%)	16 (89%)	22 (82%)
Anal sensation			
Air and water sensed	12 (26%)	2 (14%)	9 (33%)
Only water sensed	9 (20%)	9 (64%)	13 (48%)
Neither water or air sensed	15 (33%)	3 (21%)	4 (15%)
Communication difficulty	10 (22%)	0	1 (4%)

(Tukey multiple comparison test, $p < 0.001$) but no significant difference was detected between the groups of geriatric patients. A relationship was detected between mobility and anal squeeze pressure (analysis of variance, $p < 0.01$). The lowest pressures were recorded in the least mobile patients (Table 3).

PUDENDAL NERVE TERMINAL MOTOR LATENCY

This was not found to be significantly correlated with age (Pearson's correlation coefficient $r = -0.17$, $n = 55$, $p = 0.2$). Pudendal nerve terminal motor latency was similar in all four groups of patients (analysis of variance, $p = 0.35$) (Table 3).

RECTOANAL REFLEX

This test was only done on the geriatric patients. There was no significant difference between the groups in the presence of the inflation reflex (corrected $\chi^2 = 2.6$, $df = 2$, $p = 0.27$) (Table 4). The inhibitory reflex was detected in 53% of the incontinent patients which was significantly less than in the geriatric control (82%) and impacted (89%) patients (corrected $\chi^2 = 9.3$, $df = 2$, $p = 0.01$).

ANAL SENSATION

This test was only done on the geriatric patients

(Table 4). Eighty one per cent of the geriatric control patients were able to identify the presence of water in the anal canal but only 33% of these patients were able to correctly differentiate between water and air instilled into the anal canal. Nineteen per cent of the control patients and 21% of the continent impacted patients were unable even to identify water in the anal canal. This was found more frequently in the incontinent patients (55%). Forty per cent of these patients had communication difficulty. The exclusion of these patients from the analysis, however, did not alter the conclusion that there is significant impairment of anal sensation in faecally incontinent geriatric patients ($\chi^2 = 10$, $df = 4$, $p < 0.05$).

Discussion

This study has confirmed that faecal impaction, dementia, and immobility are important factors contributing towards the development of faecal incontinence in geriatric patients. The main purpose of the study, however, was to investigate anal function in these patients.

Anal squeeze pressure, which is produced by contraction of the external anal sphincter muscle, was found to decrease with age thus confirming previous reports.^{8, 11, 34} Muscle strength³⁵⁻⁴⁰ and muscle mass^{37, 40-43} generally decline in old age and there is histological^{37, 44, 45} and electrophysiological evidence^{36, 37, 46-48} to suggest that this muscle atrophy is the result of denervation. Denervation and reinnervation also appears to affect the external anal sphincter muscle in old age as the mean duration of motor unit potentials¹⁵ and fibre density^{27, 28} both increase in the external sphincter with age.

Many studies have shown an age related reduction in nerve conduction velocity.⁴⁹⁻⁵² Pudendal nerve terminal motor latency, however, was not found to change with age which suggests that the observed external sphincter weakness in the elderly is not caused by neuropathy of the distal segment of the pudendal nerve. Age related loss of anterior horn cells or motor nerve fibres from the proximal innervation of the external sphincter, however, cannot be excluded and there is evidence to suggest that this may occur in old age.^{53, 54}

An association was found between squeeze pressure and mobility. The lowest pressures were recorded in the least mobile patients which suggests that atrophy of skeletal muscle and the external sphincter may occur together because of a common underlying neurological abnormality.

The mean squeeze pressure recorded in the geriatric control patients in this study was similar to that recorded in younger faecally incontinent patients - that is, approximately 45 cm H₂O.¹³

External sphincter weakness may therefore render elderly patients liable to faecal incontinence as suggested by Read and Abouzekry²⁶ but the presence of faecal incontinence does not appear to be related to the degree of external sphincter weakness as squeeze pressure was not significantly lower in the incontinent patients than in the other geriatric patients.

The absence of any abnormality in pudendal nerve terminal motor latency suggests that pudendal neuropathy is not a major factor in the development of faecal incontinence in geriatric patients unlike the results of studies performed on younger faecally incontinent patients.^{13 14}

External anal sphincter contraction in response to rectal distension (inflation reflex) was frequently absent in the geriatric patients though there was no significant difference in the presence of the reflex between the faecally incontinent (61%), faecally impacted (50%), and geriatric control patients (41%). The incidence among the control patients was lower than expected. Read and Abouzekry²⁶ had demonstrated this reflex in 80% of their elderly control group. The high incidence of neurological disease in the patients in the current study may account for the difference between the studies. Absence of the reflex has previously been noted in paraplegic patients with lesions above the level of L1.^{55 56}

Anal resting pressure, which is almost entirely generated by the internal anal sphincter,⁵⁷ has previously been reported to decrease with age.^{8 34 58 59} The lack of any change in resting pressure with age in this study or in a small study performed by Loening Baucke and Anuras⁶⁰ and the demonstration of low anal resting pressure only in the very elderly by Matheson and Keighley¹¹ implies that this aging effect is not yet proven. Resting pressure was, however, significantly lower in the faecally incontinent geriatric patients studied which implies that there is dysfunction of the internal anal sphincter in these patients.

Internal sphincter weakness has been reported in younger patients with faecal incontinence⁷⁻¹⁴ in conjunction with external sphincter weakness but has aroused comparatively little interest. Swash¹⁷ at one stage even dismissed it as a factor contributing to the development of faecal incontinence.

There is now, however, evidence that internal sphincter dysfunction is an important factor in the development of faecal incontinence, particularly in patients with faecal incontinence and perineal descent^{61 62} in whom there is low anal resting pressure in addition to pudendal neuropathy and external sphincter weakness. Similar internal sphincter weakness has also been shown in patients with faecal

incontinence and rectal prolapse,⁶³ and in faecally incontinent diabetic patients.⁶⁴ Internal sphincter abnormalities have also recently been confirmed in patients undergoing postanal repair for severe anorectal incontinence.⁶⁵

It has been suggested that faecally impacted geriatric patients become incontinent because of either stretch or reflex inhibition of the anal sphincter muscles.⁶⁶ Anal resting pressure was not found to be affected by faecal impaction in this study or by Read and Abouzekry²⁶ and the rectoanal inhibitory reflex remains intact.

Schiller *et al*⁶⁴ reported that the onset of faecal incontinence in diabetic patients usually coincides with the onset of chronic diarrhoea. They suggest that the internal sphincter dysfunction in these patients is the result of a defect in either the autonomic innervation or the smooth muscle. Diabetic autonomic neuropathy, however, does not invariably cause internal sphincter dysfunction as continent diabetic patients have normal resting pressure even though 79% have symptoms suggestive of autonomic neuropathy.

It is unclear at present whether autonomic neuropathy contributes towards the development of faecal incontinence. Studies of patients with progressive autonomic failure with multiple system atrophy have led to the discovery of many interesting features of autonomic dysfunction.⁶⁷ Bladder dysfunction causing frequency, urgency, and urge incontinence is common in these patients⁶⁸ and low anal sphincter tone⁶⁸ and faecal incontinence⁶⁹ are also recognised features.

A myenteric plexus abnormality also appears to be present in many incontinent geriatric patients as the rectoanal inhibitory reflex was frequently absent in the incontinent patients studied (Table 4). Hirschsprung's disease had not previously been suspected in these patients. Myenteric plexus degeneration or damage can, however, probably be discounted as the cause of the internal sphincter dysfunction identified in this study as normal internal sphincter pressures have been recorded in infants with Hirschsprung's disease.⁷⁰

Anal sensation appeared to be impaired in the majority of geriatric patients. Only 33% of the control patients were able to discriminate between water and air in the anal canal (Table 4). Although this may be because of pudendal sensory neuropathy; anal sensation and pudendal nerve terminal motor latency were not found to be correlated.

Anal sensation appears to be more severely impaired in incontinent geriatric patients as they were less aware of the presence of water or air in the anal canal than the control patients. Twenty five (57%) of the 46 incontinent geriatric patients

assessed failed to identify either water or air instilled into the anal canal compared with just five (19%) of the 27 control patients assessed. Although cognitive impairment secondary to cerebral pathology – for example, Alzheimer's disease may have contributed to this loss of awareness in incontinent patients there does appear to be an abnormality in anal sensation similar to that reported in younger incontinent patients.^{23–25}

Loss of anal sensation as a single isolated factor, however, does not necessarily result in faecal incontinence, as Read and Read³² demonstrated that continence can be maintained when the anal canal is anaesthetised with lignocaine gel. This suggests that continence is only lost when a number of coexistent abnormalities are present.

Geriatric patients therefore have abnormalities in anal sensation, external sphincter strength and reflex activity which increases their risk of developing faecal incontinence. The main factor that appears to determine whether their continence is maintained is internal sphincter function.

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