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Original Article

Is there an association between back pain and stress incontinence in adults with cystic fibrosis? A retrospective cross-sectional study

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Abstract

Background: Back pain and stress urinary incontinence (SUI) are common in adults with cystic fibrosis (CF). This study aimed to establish whether there is an association between back pain, lung function and stress urinary incontinence and its relative risk.
Method: This was a cross-sectional, retrospective analysis of the Manchester Musculoskeletal Screening Tool (MMST) data. It includes pain, (Short Form McGill Pain Questionnaire (SF-MPQ and VAS)) and International Consultation on Incontinence Short Form (ICIQ-UI-SF) measures. Associations were tested using Spearman's rank correlation coefficient. Relative risk of developing symptoms was calculated the sig level was $p = 0.05$.
Results: ICIQ-UI-SF was associated with back pain (SF-MPQ) (Rho = 0.32, $p < 0.001$) and pain (VAS) (Rho = 0.23, $p < 0.01$). RR of developing SUI with back pain was 2; RR of developing back pain with SUI was 1.3.
Conclusions: An association is indicated between back pain (SF-MPQ and VAS), and SUI in adults with CF. This information is important when developing management strategies in the CF population.

Keywords: Cystic fibrosis; Back pain; Stress urinary incontinence; Lung function; Cross sectional study

1. Background

Despite improvements in management, CF remains a progressive disease. Adulthood survival brings new complications including musculoskeletal abnormalities. These are related to the conflicting demands of respiration and posture in conjunction with reduced bone mineral density (BMD) and muscle mass [1]. Fracture rates in patients with CF have been reported as twice as high as their peers by age 16, 62% of adults had excessive kyphosis and 94% reported back pain [2].

Puberty is a significant period as 25% of bone density is amassed when peak height is reached, children with CF only acquired half as much bone as healthy children [3]. Reduced bone mineral density in adults with CF is thought to be a combination of sub-optimal maturity of bone in puberty and rapid bone loss as an adult. Adults with CF have significantly reduced quadriceps strength and muscle mass compared to matched controls; this may be due to reduced activity levels and decreased BMD as opposed to reduced force generating capacity of the muscle [4].

Back pain and postural deformities are common in CF and appear to be associated with deteriorating lung function [5]. Using the CF QOL questionnaire, poor physical functioning and the presence of pain were the strongest predictors of reduced survival in CF [6]. Pain is a frequent and devastating problem in adults with CF with back pain being the most common complaint [7].

There is an interaction between muscles of postural stability and respiration; most muscles have dual roles and act to support both systems [8]. Control of increased intra-abdominal pressure is performed automatically as a feed-forward loop via the recruitment of transverse abdominis, the diaphragm and the pelvic floor. Electromyographic (EMG) recordings of the diaphragm and other trunk muscles have shown that co-ordination of tonic and phasic

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activities in the diaphragm and transverse abdominis is reduced or absent after only 60 s of hypocapnea [9]. This reduction was demonstrated in 13 healthy volunteers whilst breathing through increased dead-space and making rapid repetitive arm movements to disturb the stability of the spine for four periods each lasting 10 s, separated by 50 s [9]. Therefore, when the chemical drive to breathe is increased the muscles forego their postural role. Therefore, back pain is prevalent in adult CF where there is an imbalance between respiratory and postural demand on a spine disadvantaged by insufficient BMD and reduced muscle mass.

Stress urinary incontinence (SUI) is a secondary complication of CF involving the external support system. 70% of women with CF over 35 years of age in Manchester reported SUI [10], compared to 35% of the English and Welsh population [11]. When coughing, intra-abdominal pressure increases due to contraction of the abdominal muscles and diaphragm imposing downwards pressure on the pelvic floor muscles; the Valsalva manoeuvre. Evidence suggests that adolescent females with CF and high severity of cough are less able to reduce the displacement of the pelvic floor when coughing [12]. If the pelvic floor is unable to generate adequate, coordinated counter pressure or lacks endurance, SUI results. Frequent bouts of intense coughing in CF, especially during an exacerbation, coupled with lack of co-ordination between respiration and posture and potential reduced strength and mass of the pelvic floor mean that SUI is a significant problem in this population compared to asthmatics and normal controls [13].

There is a growing body of evidence demonstrating links between SUI and back pain [14–16]. In a study of 38,050 healthy Australian women [14], self-report data was used to establish associations between back pain, pelvic floor weakness and disorders of respiration, while considering confounding factors of BMI and physical activity. In contrast to BMI and physical activity, disorders of continence and respiration were related to back pain across all ages. A cross-sectional study of 2341 women from the Kentucky concluded that women with chronic low back pain have increased chance of developing SUI, indicating the importance of all muscles of the trunk, including the pelvic floor to function in co-ordination with one another [15], and a study of 220 women in Stockholm found 78% of women with recurrent low back pain also reported experiencing SUI [16].

Back pain and SUI are two of the most common disorders of the external support system found in CF. No studies have specifically targeted a CF population to investigate links between the two conditions. This study aims to add to the evidence base and determine, in an adult CF population, whether there is an association between back pain, lung function with SUI and its relative risk.

2. Method

This was a cross-sectional retrospective evaluation of patient records [17]. In 2012, there were 379 active patients registered at the Manchester Adult Cystic Fibrosis Centre. Annually, all patients are invited to attend a multi-disciplinary review. All physiotherapists undertaking annual review in 2012–13 were invited to administer the Manchester Musculoskeletal Screening Tool (MMST).

Permission for analysis and publication of patient data was obtained from the data control department, University Hospital South Manchester. Ethical approval was obtained from Manchester Metropolitan University. This study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [18].

3. Outcome measures

All outcome measures were collected on admission to the centre and then at annual review. All outcomes except FEV_1 were self-reported by a specialist CF physiotherapist trained in administering the outcome measures. FEV_1 was measured using Vitalograph wedge-bellows spirometers.

The MMST is a valid assessment of pain and urinary incontinence with an additional brief assessment of suboptimal spinal posture and movement in adults with CF [19]. It was developed in response to, and has been used for identification of, the prevalence of musculoskeletal disorders in adults with CF [20]. It consists of the Short-form McGill Pain Questionnaire (SF-MPQ) [21,22], the Visual Analogue Scale (VAS) [22] and the International Consultation on Incontinence Questionnaire-Urinary Incontinence-Short Form (ICIQ-UI-SF) [23].

The SF-MPQ [21], and VAS [22] were included to identify the presence and extent of pain (Permission granted by the Mapi Research Trust). The measurement of pain is challenging due to its subjective and complex nature; in order to overcome this, it is suggested that the VAS, as a one-dimensional measure of pain intensity, and the SF-MPQ as a multidimensional measure of pain are used together [22]. The SF-MPQ consists of two parts: the first is 15 descriptors (11 sensory; 4 affective), to help describe pain during the last 7 days, rated on a Likert Scale: 0 = none, 1 = mild, 2 = moderate or 3 = severe. The second is a Present Pain Intensity score: 0 (no pain) to 5 (excruciating). Total SF-MPQ pain scores are derived from the sum of the pain over the last 7 days and the Present Pain Intensity score. The minimum score is zero and the maximum score is 50 [21]. Finally, a VAS was included, using a 10 cm line bounded with the descriptors “no pain” at one end and “worst possible pain” at the other; the minimum score was zero and the maximum score was 100.

The ICIQ-UI-SF [23] is a valid and reliable measure of stress urinary incontinence [24]. It has good content and construct validity, demonstrating a clear differentiation between sex and perceived causes of incontinence [23]. It provides a consistent and unified approach to the measurement of incontinence and its impact on quality of life across the general population [23]. The questionnaire consists of three questions summed into a single total score. The minimum score is 0 and the maximum score is 21.

The percentage of predicted FEV_1 ($\%FEV_1$), is the patient percentage of predicted FEV_1 divided by the average population percentage of predicted FEV_1 for any person of similar age, sex and body composition. It is commonly used to measure lung function in CF [25]. $\%FEV_1$ was calculated using the Pulmonary Function Reference Normal Predicted Values Calculator from The

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