Fear of falling in claudicants and its relationship to physical ability, balance and quality of life

Authors: **Email addresses:**

Risha A Gohil, MBChB,[1] risha@doctors.net.uk

Katherine A. Mockford, MBChB,[1] katherinemockford@hotmail.com

Fayyaz Mazari, MRCS,[1] fayyaz.mazari@hey.nhs.uk

Natalie Vanicek, PhD,[2] natalie.vanicek@sydney.edu.au

Ian C. Chetter, MD, FRCS[1] ian.chetter@hey.nhs.uk

Patrick A. Coughlin, MD, FRCS[3] pacoughlin@aol.co.uk

Institutions:

[1]Academic Vascular Surgical Unit, Hull Royal Infirmary, Hull, Hull York Medical School, University of Hull, UK

[2]Discipline of Exercise and Sport Science, Faculty of Health Sciences, University of Sydney, NSW 2141, Australia

[3]Addenbrookes Hospital, Cambridge

***Corresponding author contact details:**

Risha Gohil, Clinical Research Fellow

Academic Vascular Surgical Unit, First Floor Vascular Laboratory,

Hull Royal Infirmary, Hull, HU3 2JZ UK

+44 1482 675523

risha@doctors.net.uk

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Abstract

Objectives. Intermittent claudication is associated with poor physical function, quality of life (QoL) and balance impairment. Fear of falling (FoF) is a recognised contributing factor to poor physical ability. Any link between claudication and FoF is yet to be determined. This study aimed to explore the prevalence of FoF in claudicants, its relationship with physical function and QoL.

Methods. A prospective observational study was performed. FoF was determined using the ABC questionnaire and the categorical question "are you afraid of falling?" Physical ability and QoL (SF36, VascuQoL) were determined.

Results. 161 claudicants (118 men, median age of 69 years) were assessed, 83 answered the categorical question "Are you afraid of falling?" By ROC curve analysis, an ABC threshold <74% denoted a FoF, which was associated with poorer physical function and QoL.

Conclusion. FoF is associated with poor physical, social and psychological function, addressing this may improve all aspects of health.

Keywords: fear of falling, intermittent claudication, quality of life

Introduction

Fear of falling (FoF) is a complex psychological problem that has been defined as a 'low perceived self-efficacy at avoiding falls during essential non-hazardous activities of daily living.'[1] The prevalence of FoF varies depending on whether there is a personal history of a previous fall, experience of someone else's fall or insight into ones own poor mobility. In view of the multifaceted nature of fear, it is important to remember that it may be appropriately grounded in personal experience or inappropriate and restrictive.[2] A significant proportion of people exhibit poorer physical ability in conjunction with a FoF, and it has been hypothesised that such people adapt their behaviour and develop "falls avoidance tactics", namely a lowering of their daily physical activities and activity avoidance.[2-4] A reduction in physical activity has been demonstrated to have a detrimental effect on morbidity and mortality in longitudinal cohort studies,[5] and may also impinge on quality of life (QoL).[6] FoF has also been demonstrated to influence the probability of falling leading to muscle atrophy and weakness .[7-8] The muscle atrophy is likely to be secondary to reduced mobility and falls avoidance, however the sedentation leads to a cycle of fear and immobility which may become difficult to break.[9]

Vascular intermittent claudication is increasing in prevalence as the population ages[10-11] and primarily impacts on an individual's walking distance. Over the past twenty years research has highlighted that walking distance is not reduced in isolation; there is also an associated reduction in lower limb strength,[12] walking speed,[13] distance,[14] quality of life,[15] balance[16] and physical functional ability.[17] To date the impact of vascular compromise on balance has been explored with variable findings,[18-19] however the prevalence of fear of falling in this cohort remains unknown. In addition the effect that fear may have on physical functional ability, walking and quality of life in claudicants has also been largely ignored in

this group of patients. As such, fear of falling may be a "missing link" in assessing the overall assessment of physical ability in claudicants.

The Activities Balance Confidence (ABC) questionnaire is a questionnaire developed to measure an aspect of the psychological impact of balance impairment and/or falls. Threshold values have been reported for individuals at an increased risk of falls (<67%),[20] with poor mobility (<50%),[21] and have reported the mean score of those with a fear of falling as either 68.7% (+/-23.4%) or 30.8% (+/-16.2%) in those who displayed activity avoidance.[22]

This paper aimed to initially determine a threshold value for what constituted a fear of falling in a cohort of claudicants using the ABC questionnaire.[23] Our secondary aim was to determine the relationship between FoF and balance impairment, falls history, physical ability and QoL in our claudicant population.

Methods

Data were collected prospectively from claudicants at a single academic vascular unit over a four-year period (March 2007 to March 2011). The study was approved by the East Yorkshire and North Lincolnshire REC (protocol 07/Q1105/12). All claudicants were enrolled as part of an on-going study assessing the effect of intervention in claudicants. Patients were included if they had evidence of a lower limb vascular stenosis by any vascular imaging modality (MRA, CT angiogram or duplex), or with a compromised ankle brachial pressure (ABPI<0.9). If their ABPI was not reduced, an exercise constant load treadmill test was performed to identify if a drop in ABPI occurred, allowing those with intermittent claudication to be diagnosed and included in the study. Individuals were excluded if they had no reduction in their ABPI post exercise, if they had evidence of critical limb ischaemia / tissue loss or significant cardiovascular or respiratory compromise that prevented completion of the assessments listed below.

All patients underwent a single assessment of their clinical indicators of lower limb ischaemia, quality of life, fear / history of falling, balance and physical functional ability.

Clinical indicators of lower limb ischaemia

Measurement of the ankle brachial pressure index (ABPI) was performed using a standard sphygmomanometer and a handheld Doppler with an 8-MHz probe (Huntleigh Technology plc, Cardiff, UK). ABPI measurements were assessed before and after a constant load treadmill test (speed 2.6 km/hour, gradient 10 degrees, maximum of 5 minutes).[24] Initial claudication distance (ICD) was defined as the onset of claudication symptoms that a patient experienced when walking on the treadmill, the time at which this experience was recorded in seconds and the subsequent distance then calculated in metres. The absolute treadmill walking distance (AWD) was defined as the absolute walking distance that an individual could walk before pain secondary to their claudication stopped them. The AWD was recorded in seconds,

however a ceiling limit of 300 seconds (5 minutes, 214.5m) was applied to the test. This ceiling limit of five minutes was used to allow grading of the claudicants according to Rutherford Grade.[24]

Quality of Life

This was assessed using two self-completed QoL questionnaires, a disease specific (VascuQoL)[25] and generic (Short form 36 - SF36) questionnaire.[26] The VascuQol has been well validated in the claudicant population and utilised by our group as it allows both claudicants who remain stable and those who progress on to develop critical limb ischaemia to both be assessed using the same outcome measure.[27] The SF36 is well established as a valid, reliable and responsive generic QoL instrument recommended for use in patients with claudication.[15] It is a generic quality of life instrument that has been well validated in the general UK population for normal healthy individuals.[28]

Not only do the QoL instruments allow us to assess domains of physical function, but within this study allow us to analyse the social and emotional aspects of health and how they are associated with a fear of falling.

Fear of Falling (FoF)

The Activities Balance Confidence (ABC) questionnaire is a well-validated 16-item questionnaire which assesses the psychological impact of balance impairment and/or falls.[29] Each question uses a 10-point Cantrill ladder scale from 0 (afraid/no confidence) to 100 (not afraid/complete confidence) from which the mean score is calculated. A mean score of less than 67% was previously found to be 84.4% sensitive and 87.5% specific for identifying those with a positive falls history and hypothesised to act as a predictor for the likelihood of subsequent falls.[20] No specific threshold value has been identified in the literature that is representative of FoF in the claudicant population. A subset of the claudicant cohort were also asked the additional question; ‘Are you afraid of falling?’ with results recorded as either yes

or no. This simple question assessing fear of falling has been stated to have a high test retest reliability.[2]

History of Falling

This was elicited through the use of a single question at the start of the questionnaire which asked whether an individual had sustained a fall in the previous six months. A positive falls history was defined as 'a loss of balance resulting in collision with a lower surface or the floor, not as a result of an overwhelming hazard that would result in a fall by young people,'[30] whilst a positive stumbles history was defined as 'a loss of balance that was restored before a fall occurred.' A positive falls and stumbles history for the previous 6 months was determined from each patient. The reliability and validity of a questionnaire based approach to self-reporting previous falls or stumbles is unknown but is a commonly utilised method in falls studies.[31-2]

Assessment of Balance

This was assessed using computerised dynamic posturography (CDP) with the EquiTest (NeuroCom International Inc, Clackamas, OR, USA) system.[33] This system measures both static and dynamic balance. Specifically we used the sensory organisation test (SOT). The SOT measures balance using six different conditions (both static and dynamic), as previously described by Mockford *et al*.[16] In brief, the individual is asked to stand quietly on a platform that is sway-referenced and causes rotation about the ankle joint in the sagittal plane. A surrounding screen, also sway-referenced, moves in an anterior-posterior direction. The movements produced by the platform and surrounding screen mirror the natural sway of the individual. i.e. if the subject moves their centre of pressure forwards, then the platform may tilt forwards along with the surrounding screen. The SOT is able to stratify its 6 component tests into 3 different aspects of balance: somatosensory, visual and vestibular. The NeuroCom International Software package (NeuroCom system Version 8.1.0, 1996-2006) was used to

collect and analyse data obtained from the SOT. The CDP SOT is reliable and valid assessment method (ICC >0.6).[33]

Data obtained consists of numerical scores and compare the postural sway that an individual undergoes to an age-matched normative database. An abnormal SOT is defined as a score that lies within the 5% of outliers (greater than two standard deviations from the mean score) who have a balance disorder (as previously determined by NeuroCom).[33] The Neurocom values for abnormal balance are stratified according to three distinct age groups; 20–59, 60–69, and 70–79 years. In our cohort, anyone over 79 years of age was compared to the 70-79 age groups balance ability to determine whether their SOT values fell amongst the 95% of normal healthy individuals or was classed as abnormal (a failed SOT test).[33]

Assessment of Physical Functional Ability

This was assessed using three distinct tests; the Summary Physical Performance Battery (SPPB),[34-6] the timed up and go (TUG) test[37] and hand grip strengths.[38-9]

The summary physical performance battery (SPPB) comprised of three differing assessments: gait velocity (4 metre walk test), chair stand time and ability to maintain a 10-second tandem stance. Each component is graded between 0-4 to provide a cumulative score between 0 (no physical functional ability) – 12 (full ability). This study has been used as an assessment of physical ability in a number of previous claudication studies.[40-2]

The TUG test requires an individual to stand up from a standardised chair height, walk 3m, turn 180 degrees and return to a seated position. This test was performed three consecutive times with a thirty second gap allowed between each test. The fastest time in seconds was recorded as the individual's TUG score.[37]

Hand grip strengths were assessed using a hand dynamometer. Whilst sitting, individuals were asked to extend their elbow, grip the dynamometer as hard as they could for five seconds. The test was repeated three times and the mean score calculated for each arm.[39]

Statistical analysis

This was performed non-parametrically due to the non normal distribution of the data. Therefore all results are expressed as median and interquartile range, or percentages where appropriate. All analyses were performed using SPSS version 19.0. A Receiver operating characteristic (ROC) curve[43] was drawn for the categorical yes / no answers to the question ‘are you afraid of falling?’ A cut-off threshold for the continuous ABC (0-100) questionnaire was then identified from the data. The sensitivity and specificity of this data was determined from the data.

Results

In total, 161 claudicants were assessed, 118 men with an overall median (IQR) age of 69 (64-74) years. Median BMI (IQR) was 28.4 (25.9-31.1), and resting pre-exercise ABPI was 0.66 (0.53-0.86). Of the 161 recruited, all completed the ABC fear of falling questionnaire. An initial subset of 83 patients (51.55%) completed the yes/no question of "are you afraid of falling?" Their demographics are displayed in table I.

Determination of "cut off" ABC value for those with a FoF in the claudication population

Of the 83 patients who answered the categorical yes/no question, 22 (26.5%) patients stated that they were afraid of falling. This group of 22 patients contained more women and had an increased numbers of patients with osteoarthritis (Table 1). By ROC curve analysis, a threshold value < 74% was deemed to be associated with a fear of falling (Figure 1). A sensitivity of 0.82 and specificity of 0.81 was noted at an ABC threshold value score of 74%. The area under the curve was 0.856, with no crossover points in the data set. The demographics of our cohort were re-analysed to assess whether the 74% was affected by baseline demographics of the cohort (see Table II).

Assessment of FoF and association with markers of physical ability, balance and QoL

The overall median (IQR) ABC score for the total claudicant cohort was 83.06 (64.60-94.13). Applying the ABC < 74% cut-off value; 59 claudicants (36.6%) were categorised as having a FoF. This group with fear (n=59) had a lower median SOT score and reduced physical functional ability compared to those without fear (ABC score $\geq$ 74%; Table II). Significant differences were also seen in both generic (SF36) and disease specific (VascuQoL) QoL health domains between those with and without a FoF (Figure 2a and 2b).

Discussion

The aetiological complexity of falls is in part physical in nature but there is certainly an associated psychological element as well. As such, FoF is likely to have an integral role in the risk of falling and associated poorer physical ability. Increasing evidence is available on the physical aspects that may predict falling in patients with PAD[8,16,18] (balance, limb strength etc..) but there is sparse data examining the more psychological elements.

This study demonstrates that a FoF corresponds to poor physical ability as well as poorer global and specific quality of life indices. The lack of prospective follow up means that it is difficult to predict cause or effect but there is a large body of evidence that FoF is a risk factor for subsequent falls as well as being a factor in the curtailment of physical activities resulting in immobility and functional dependence[44-6]. Indeed, on the back of such findings, some groups have suggested screening for FoF in "at risk" groups.[47] As such, this is an important concept to explore in the claudicant population given the associated age and demographic profile.

We have initially determined a cut-off score for FoF of 74% using the ABC questionnaire. It may be argued that a specific yes / no answer to the question "do you have a fear of falling" may suffice as a screening tool[2]. However, we feel that using a questionnaire based approach to determine FoF may actually unmask those patients who do have a FoF but do not want to admit to it in a specific yes/no question.[22]

Furthermore, the use of the ABC questionnaire allows a more global assessment of falls risk and allows a comprehensive comparison with other disease states. At present, the literature discusses FoF in the context of two questionnaires, the Falls efficacy scale and the Activities-specific Balance Confidence (ABC) Scale. These scales have both been well

validated and correlate highly to one another.[48] Whilst the ABC questionnaire has been widely quoted for its 67% cut-off score, this has ostensibly been used to determine falls risk. In this study our aim was to assess FoF and as such our data suggests that raising this score (to 74%) may identify those afraid of as well as those at risk of falling. As such the use of the ABC score may allow both of these groups (at risk of falls and afraid of falls) to be targeted for additional balance based physiotherapy interventions (tai chi / yoga / structured exercise programmes) in patients with peripheral arterial disease. Validation of such a score would be needed in other disease states as well as healthy individuals, but is supported by previous published literature.[22] Targeted intervention to those at risk patients is likely to lead to an improvement in confidence and ability thus allowing more people to improve their quality of life, prevent depression and subsequent isolation, common findings within all groups with chronic debilitating health conditions.

There are a few specific outcomes from this study to which we should draw attention. Firstly, a gender difference is present for those with and without FoF with women having increased FoF. The reasons for this in what is predominantly a male disease need further exploration. Of further note, was the lack of association between age and either FoF or the dynamic balance assessments. This suggests that age alone does not play a role in FoF.

We acknowledge that the cross-sectional observational nature of the study does limit somewhat the extent to which we can draw major conclusions. For example it is difficult to determine whether de-conditioning occurs secondary to vascular claudication and associated physical impairments or whether it is due to a person's fear of falling. It is most likely that these act synergistically resulting in a downward spiral with an increased risk of falling (and the associated socioeconomic consequences), a more sedentary lifestyle and increased dependence. What is clear is that this reduction in physical activity as a result of both physical and psychological aspects will ultimately lead to increased morbidity and mortality in the

longer term.[42] Identification of an "at risk" group using the ABC score would allow targeted intervention to be initiated which could include an appropriately supervised exercise programme (already a recognised treatment modality for claudication). Although well studied in general, the effect of exercise in balance and falls related outcomes in the claudicant population is yet to be determined.

Maximising opportunities to keep ageing nations more mobile, strong and maintaining their physical function and balance seems a key area to target and the ABC may help identify such individuals. As the cost of care for the elderly rises, keeping people mobile, free from falls and within their own homes becomes a focus not only for geriatricians but for governments and all health care workers.

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GRAPHICS

Tables

Table I: Comparison of claudicants who answered either “yes” or “no” to the question, ‘Are you afraid of falling?’

Demographics	N Fear of Falling (Y/N)		P value
	Fear	No fear	
Age, years; median (IQR)	69 (63-78)	66 (62-72)	0.366*
BMI, median (IQR)	27.8 (26.4-32.4)	28.3 (26.2-30.6)	0.962*
Gender (m:f)	9:13	47:14	0.002º
Pre-exercise ABPI, median (IQR)	.68 (.49-.83)	.63 (.53-.79)	0.665*
HTN	17/22	44/61	0.639º
IHD	10/22	24/61	0.617º
Hypercholesterolaemia	18/22	46/61	0.540º
Previous CVA/TIA	6/22	9/61	0.312^
Diabetes	8/22	10/61	0.060^
OA (Y)	15/22	25/61	0.029º
Smoker Current	4	21	0.223^
Ex	15	29	
Never	3	11	

Table II: Comparison of claudicants by their ABC score; > or = to 74% (not afraid) versus <74% (afraid of falling)

Demographics	ABC threshold score (74%)		P value
	Fear (<74%)	No fear (> or =74%)	
Age, years; median (IQR)	69 (63-77)	66 (64-73)	0.843*
BMI, median (IQR)	27.7 (25.3-30.9)	28.9 (26.1-32.5)	0.092*
Gender (m:f)	28:20	90:23	0.005º
Pre-exercise ABPI, median (IQR)	.65 (.48-.83)	.68 (.55-.86)	0.256*
HTN	34/48	84/111	0.522º
IHD	19/47	43/110	0.876º
Hypercholesterolaemia	37/48	87/111	0.856º
Previous CVA/TIA	13/47	16/111	0.157^
Diabetes	12/48	29/113	0.930^
OA (Y)	28/46	48/109	0.055º
Smoker Current	18	27	0.236^
Ex	24	66	
Never	24	18	

Hypertension (HTN): systolic blood pressure greater > 140mmHg, or 130mmHg in diabetics, or the need for antihypertensive medications.

Ischaemic heart disease (IHD): History of angina, previous MI or coronary artery bypass graft (CABG).

Osteoarthritis (OA): previous clinical / radiological diagnosis of arthritis within any joint of the lower limb or pain within any joint of greater than 3 months duration.

ABPI: ankle brachial pressure index

Hypercholesterolaemia was defined as any individual requiring statin therapy

CVA/TIA: cerebrovascular incident / transient ischaemic attack

Ex smoking status was defined as having stopped for one year

Values are expressed as median (IQR) or proportions where appropriate. Analysis was undertaken using $^{\wedge}$ Likelihood ratio, *Mann Whitney U test or ^{O}Pearson Chi-squared test.

Table III: Comparison in markers of physical function between claudicants with an ABC score <74.0 (FoF) and those claudicants without a FoF (ABC score >/= 74.0)

		Median (IQR)	MWU (p)
Dominant Hand Grip Strength:	Fear	28.7 (20.5-38.1)	.052
	No fear	32.9 (24.4-40.9)	
Timed Up & Go Test (secs):	Fear	11.02 (9.00-13.71)	<.001
	No Fear	8.06 (7.12-9.50)	
Composite Sensory Organisation Test (SOT):	Fear	62.5 (42-72)	.014
	No Fear	67.0 (60-75)	
6 minute ICD (m):	Fear	70 (40-120)	<.001
	No Fear	120 (80-200)	
6 minute MWD (m):	Fear	120 (80-240)	<.001
	No Fear	322.50 (240-430)	
Normal 4m walk (secs):	Fear	4.53 (4.00-5.90)	<.001
	No Fear	3.60 (3.30-4.20)	
Tandem Stance (secs):	Fear	16.00(7.47-30.00)	<.001
	No Fear	30.00(19.00-30.00)	
Chair Stand Time (secs):	Fear	15.94(13.70-21.57)	<.001
	No Fear	12.47(9.93-16.04)	
Short Physical Performance Battery Score (SPBB)	Fear	9.50 (8.00-10.00)	<.001
	No Fear	10.00 (9.00-12.00)	

Comparison in markers of physical function between claudicants with an ABC score <74.0 (FoF) and those claudicants without a FoF (ABC score >/= 74.0)ICD, initial

claudication distance. MWD, Maximum walking distance. MWU, Mann Whitney U test

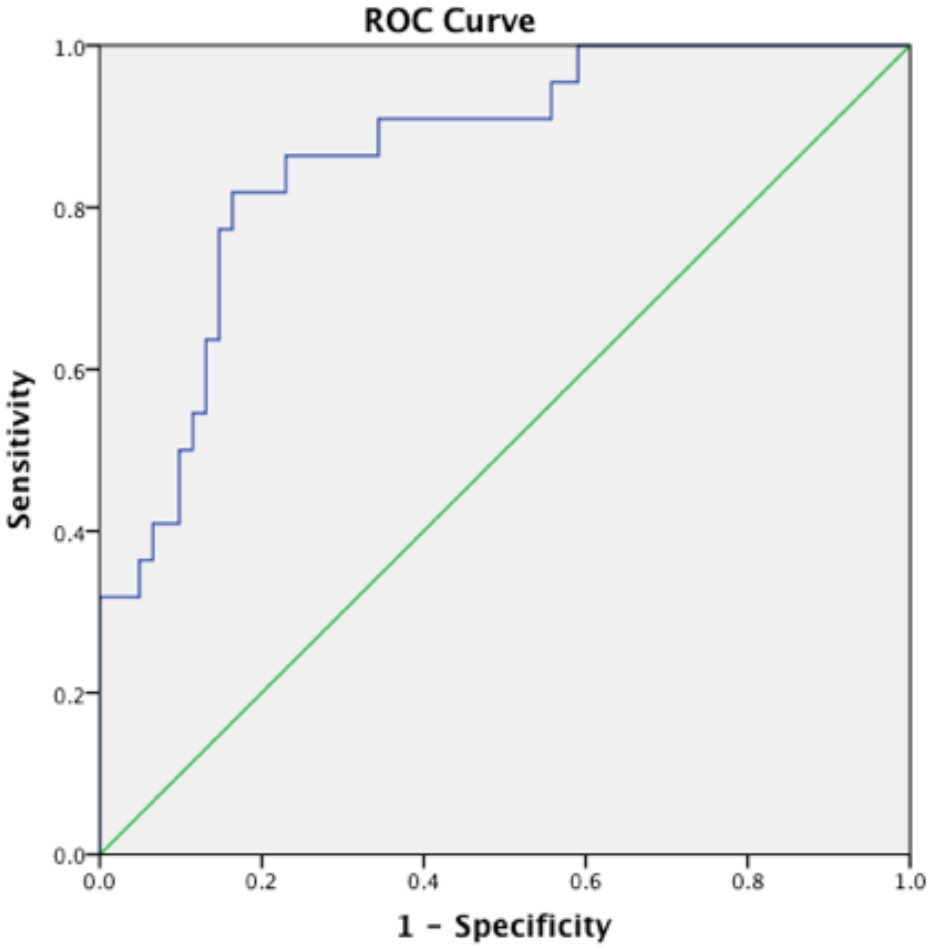

Figure 1: By ROC curve analysis, an ABC threshold value < 74% was deemed to be associated with a fear of falling. A sensitivity of 0.82 and specificity of 0.81 was noted at an ABC threshold value score of 74%. The area under the curve was 0.856, with no crossover points in the data set.

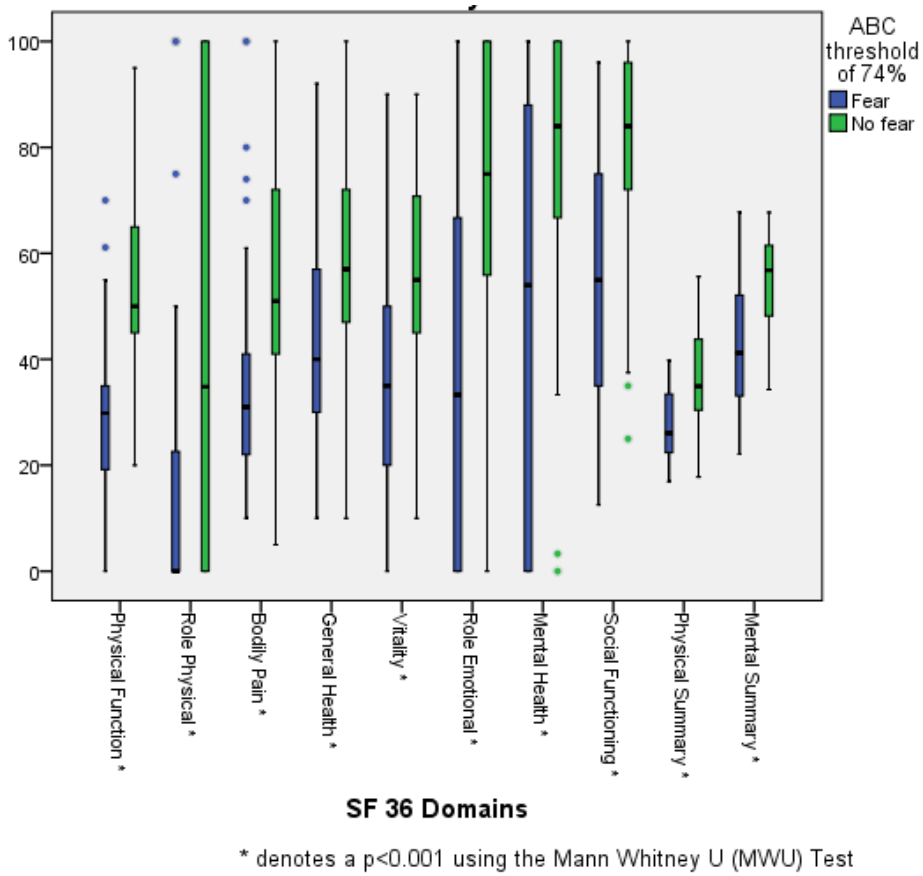

Figure IIa: Boxplots showing SF36 QOL scores for all domains for those patients with and without FoF as determined by the ABC 74% threshold.

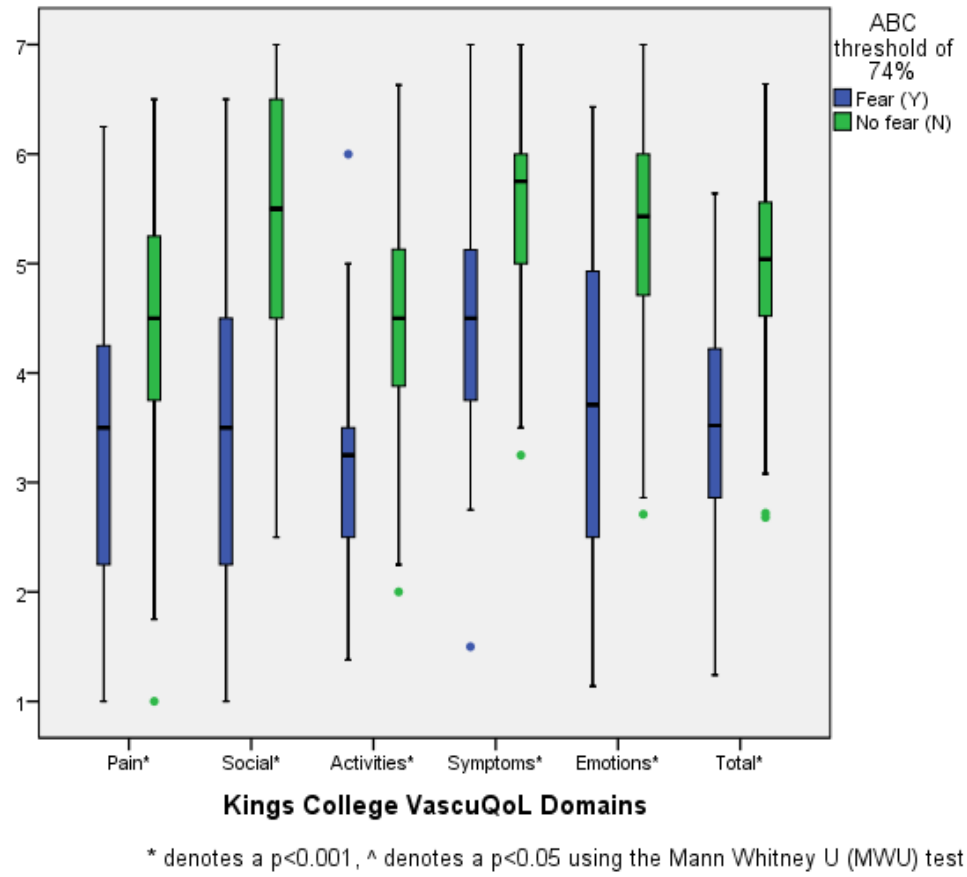

Figure IIb: Boxplots showing VascuQol QOL scores for all domains for those patients with and without FoF as determined by the ABC 74% threshold.