SCREENING FOR CLAUSTROPHOBIA IN MRI – A PILOT STUDY

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Abstract

Purpose- Claustrophobia during MRI examinations still presents a significant burden for patients and the NHS. Despite many strategies being suggested to reduce this burden, many are not routinely practiced due to questions over their cost-effectiveness. One way to ensure that strategies are cost effective is to screen for those patients who are most likely to experience difficulties during the examination.

Method – This pilot study utilised the Claustrophobia Questionnaire (CLQ) to determine its predictive qualities in screening for claustrophobia in MRI. A retrospective sample of patients who withdrew from the MRI examination (citing claustrophobia as the cause) were cross matched against a population who were able to tolerate the exam.

Results – The results were analysed using Mann Whitney and demonstrated a significant difference in the scores between those who could tolerate the MRI environment and those who could not.

Conclusion – The CLQ may be a valid tool for screening those patients who may be unable to tolerate MRI examinations prior to attendance, enabling strategies to be targeted to this particular group.

Keywords: Claustrophobia, CLQ, MRI

Introduction

Claustrophobia in MRI presents significant costs to both the health service and to the patient in terms of delays to their diagnosis. Currently no screening test is available to identify these patients prior to attendance. This study aimed to assess the efficacy of the claustrophobia questionnaire in screening for claustrophobic reactions in patients attending for MRI examinations.

Main Text

The incidence of anxiety, panic or claustrophobia during MRI examinations comes under much debate; Melendez and McCrank (1991)

report that between 5 and 10% of patients experience severe psychological distress, panic or claustrophobia, whilst another 30% experience considerable apprehension; Quirk et al (1989) state that two out of three patients feel anxious or claustrophobic; Thorpe et al (2008) argues this figure to be 15%; and Grey et al (2000) estimates the figure to be between 1% and 30%. Figures also vary significantly when discussing how many patients 'withdraw' from the examination as a consequence of feeling claustrophobic, with some authors setting the figure as low as 5% (Phillips and Deary 1995) and others arguing that as many as 20% of patients withdraw from the procedure (Klonoff et al 1986). The incidence of claustrophobia in the general populous is around 4% (Thorpe et al, Ost et al 2001), so we argue that a figure of 4% more accurately represents the number of withdrawals in MRI due to claustrophobia, as it is recognised that patients who have no previous experience of MRI imaging, have had a previously negative experience in MRI, or who believe they have cancer also exhibit high anxiety responses to the examination (Brennan et al 1988) and these patients might contribute to the number of patients who withdraw from MRI examinations, For example Mackenzie et al (1995)found pre-MRI anxiety states to be equivalent to those about to undergo elective surgery.

Although Brennan et al (1988) found no association between gender and claustrophobia in MRI, the work of Dewey et al (2007) and Murphy and Brunberg (1997) demonstrate that certain factors seem to correlate with an increase in claustrophobic reactions including; being female; going into the scanner head first; and a previous negative experience of MRI. The latter also suggests that the experience of MRI induces or increases feelings of claustrophobia in some patients. This finding seems to be supported by the work of Kilborn and Labbe (1990) who demonstrated that almost 10% of patient's interviewed one month after withdrawing from an MRI examination felt more nervous in confined spaces when compared to those patients who were able to complete the examination. Harris et al (1999) argues that this is due to patients who tolerate the examination experiencing a sort of 'exposure trial', a technique that has been used by psychologists in the treatment of phobias, whereas those who withdraw from the examination when experiencing high fear/anxiety effectively reinforce the idea that 'escape' is an effective strategy for dealing with that fear when faced with a similar situation again. Nonetheless, neither Kilborne and Labbe nor Harris effectively explain the findings of Fishbain et al (1988) who found that claustrophobia can also develop in patients who tolerate high anxiety levels and remain in the scanner throughout the procedure.

The true cost of the effects of claustrophobia in MRI is not known. However, limited data demonstrate costs associated with an increase in scanner time; failed appointments (Murphy and Brunberg (1997); movement

unsharpness (Mackenzie et al 1995) and delays to patient diagnosis and treatment (Lukins et al 1997). Given that many phobic individuals will cope with their phobia using a defensive-avoidance approach (Larson et al 2006), it is likely that a large proportion of missed appointments (DNAs) are also a consequence of claustrophobia. Defensive avoidance is a term used to describe a reaction displayed by an individual when presented with a threat stimulus. This stimulus creates a strong Amygdale response and so, in order to avoid the feelings associated with this response, the individual will 'avoid' the stimulus altogether. Although there are no current UK figures that look at the costs associated with problems caused by claustrophobia in MRI it is estimated in the US that if 3-5% of patients terminate examinations, and if the average cost of an MRI is $500, then the overall net loss is $6,525,000 (Murphy and Brunberg 1997).

Anxiety is a normal emotional reaction to a potential stressor. It is an important catalyst within the human body that has the function of mobilising physiological reactions; such as accelerated heart beat and increased respiration to prepare the body for possible evasive action, a reaction that is often referred to as the 'fight or flight' response (Asbar 1993). It is recognised that anxiety is a useful trait shaped by natural selection, in that individuals who had the capacity to detect and react to potential danger lived longer, and had more descendents than those who did not (18). Humans therefore have a natural capacity for normal defensive arousal, and have also developed subtypes of normal anxiety responses to protect against particular kinds of threats e.g. escape or avoidance (withdrawal or DNA); aggression; and freezing/immobility (becoming physically/cognitively immobilised) (Marks and Nesse 1994). However there are cases when this anxiety response is irrational or disproportionate to the danger presented (Davison et al 2003), and individuals have a tendency to associate anxiety more quickly with certain cues than with others (Marks and Neese 1994). These disproportionate reactions are labelled phobic reactions and Claustrophobia is classified in DSMIV as a specific phobia under the category of situational phobias (Ost et al 2001, Ost 2006).

Claustrophobia is defined as a 'fear of enclosed spaces' (Harris et al 1999). However, more recent approaches to understanding claustrophobia have suggested that the phobia is comprised of two separate fears: a fear of restriction and a fear of suffocation (Radomsky et al 2001). As already suggested anxiety is a defensive reaction which has its basis in natural selection; to feel anxious when one finds themselves trapped with no means to escape from danger is a normal and useful physiological response. In individuals who are claustrophobic this response has become pathological. "It is not that individuals are afraid of enclosed spaces per se, it is the fear of what might happen in that enclosed space" (Radomsky et al 2001). The idea

that a fear of suffocation might also play a part in the claustrophobic reaction is due to claustrophobic patients expressing a fear of suffocation whilst in an enclosed space, a fear that is exacerbated by feelings of shortness of breath (Radomsky et al 2001). The MRI environment, with its narrow bore, long tunnel and body coils, certainly creates a situation where this fear might be realised for patients. Add to this the increased respiration associated with the fight/flight response (Brenan et al 1988) and the fact that individuals tend to overestimate how much oxygen the body really needs (Rachman and Taylor 1993), it seems sensible to include a fear of suffocation when assessing the presence of claustrophobia.

There are a number of strategies available to reduce the fears associated with claustrophobia in MRI, although no Randomised Controlled Trials exist to demonstrate which might be the most effective. Perhaps one of the most common methods employed in UK hospitals is the use of information leaflets (Tischler et al 2008), although if these provide procedural information alone they have little impact on anxiety (Byers et al 1984). Patients contacting the department, use of music and communication during scanning are also commonly used methods of reducing anxiety in MRI (Phillips and Deary 1995, Tischler et al 2008) However problems associated with anxiety/claustrophobia, failed examinations, use of sedation and anaesthetic remain, and therefore the efficacy of these methods must be questioned. A number of anxiety reducing interventions are also suggested in the literature; Neurolinguistic Programming (NLP) has demonstrated a reduction in the need for anaesthesia in claustrophobic patients undergoing MRI (Bigley et al 2009); of 50 adults who had previously undergone unsuccessful MRI because of claustrophobia, 76% were able to complete the MR examination successfully after an NLP intervention; Using scanners with a shorter bore (Spouse and Gedroyce 2000); pre-scan visits or using MRI simulators for prior rehearsal (Rosenberg et al 1997) have also been found to be successful in reducing anxiety; and Thompson (Thompson and Coppens 1994) found patients who had listened to a guided imagery relaxation tape before attending for an MRI examination showed a decrease in anxiety which remained low after the scan had finished.

However, although the literature suggests these interventions for alleviating anxiety during MRI examinations their uptake in general MRI departments have been low. Tischler et al (2008) in their study of radiographer's attitudes towards such interventions suggests that resource restrictions make these procedures too time consuming for routine use. However, if a method existed where it was possible to screen for claustrophobic reactions, then these interventions may become more time and cost effective than the strategies currently employed.

One screening method that detects the presence of both a fear of restriction and a fear of suffocation is the Claustrophobia questionnaire (CLQ) devised by Radomsky et al (2001). It was originally a 30 item 5 point Likert scale with each item relating to situations that were either restrictive or suffocative in nature. It was refined by McIsaacs et al (2001) to give 14 statements that relate to a fear of suffocation and 12 statements relating to a fear of restriction using a 4 point Likert scale. Although the data collected is ordinal, the data is actually added together to give nominal scores for the fear of suffocation and the fear of restriction. Despite its nominal nature, tests of reliability and validity have shown that the CLQ can distinguish between those who have claustrophobia and those who do not and it has also demonstrated excellent inter-rater reliability with Beck's Anxiety Inventory; the anxiety Sensitivity Index; and the Social Phobia and Anxiety Inventory (McIsaac et al 2001). It has also been demonstrated as having a greater predictive value in identifying patients who may experience anxiety during MRI scans than other tools such as the Anxiety Sensitivity Index (McIsaac et al 2001)

In an attempt to demonstrate that the CLQ might be imported into MRI for the screening of phobic individuals a small retrospective pilot study consisting of 100 patients was undertaken.

Despite a number of studies being undertaken using the CLQ in the diagnosis of claustrophobia and the use of the CLQ in MRI, we could find no studies that directly compared the scores of patients who were unable to undertake the examination and those that could and it was for this reason a retrospective analysis of previous MRI patients was undertaken.

Method

One hundred patients were selected from two groups. The first group consisted of those patients who were able to complete the MRI examination and the second comprised of patients who were unable to complete due to claustrophobia. The diagnosis of claustrophobia was given (and recorded) by the radiographers undertaking the procedure and is a diagnosis routinely given to all patients who cannot complete the examination. For this reason it was expected that this group would include patients who were not claustrophobic but could not complete the examination due to increased anxiety and/or fear of diagnosis. Similarly we suspected that our non-phobic group might contain individuals who had mild to moderate claustrophobia but had been able to tolerate the examination.

The sample had a strict inclusion/exclusion criterion. Excluded patients were all those under the age of 18; patients who had a terminal illness; and acute patients, due to ethical requirements set out by the universities ethics committee. Patients who had been sedated; and those who

had previous experience of MRI were also excluded as these would introduce unwanted variables as suggested by Murphy and Brunberg (1997).

The inclusion criteria were those patients that were most representative of patients who might experience a claustrophobic reaction. In view of the findings of Dewey et al (2007) we only included patients who had to enter the scanner completely i.e. head, chest, and upper abdominal examinations, we also wanted equal numbers of both male and female patients.

To ensure this sample a 'quota' sampling method was employed, with strata comprising of (1) phobic and non-phobic individuals and (2) male and female patients. Fifty patients were selected from the final strata to ensure the required sample size.

These patients were then sent a copy of the CLQ, see table 1, along with a covering letter and a stamped addressed envelope, in an attempt to increase response rates. As the questionnaire was completed anonymously a simple code on the questionnaire indicated whether the returned questionnaire came from a phobic or non-phobic participant. Of the 100 questionnaires sent out 42% were completed and returned; 23% from the non-phobic group and 19% from the phobic group. With hindsight the team should have factored into the sample size the non-compliance that is often associated with postal questionnaires. However, as this was a pilot study with limited resources and given that 43% is a reasonable response rate for a postal questionnaire study we felt that the sample size was still big enough to perform our calculations.

Table 1 – The Claustrophobia Questionnaire

	Questionnaire					
		Not at all anxious	**Slightly anxious**	**Moderately anxious**	**Very anxious**	**Extremely anxious**
1	Swimming while wearing a nose plug	0	1	2	3	4
2*	Working under a sink for 15 minutes	0	1	2	3	4
3*	Standing in an elevator on the ground floor with the doors closed	0	1	2	3	4
4	Trying to catch your breath during vigorous exercise	0	1	2	3	4
5	Having a bad cold and finding it difficult to breathe through your nose	0	1	2	3	4
6	Snorkelling in a safe practice tank for 15 minutes	0	1	2	3	4
7	Using an oxygen mask	0	1	2	3	4
8*	Lying on a bottom bunk bed	0	1	2	3	4

9	Standing in the middle of the third row at a packed concert realising that you will be unable to leave until the end	0	1	2	3	4
10	In the centre of a full row at a cinema	0	1	2	3	4
11	Working under a car for 15 minutes	0	1	2	3	4
12	At the furthest point from an exit on a tour of an underground mine shaft	0	1	2	3	4
13	Lying in a sauna for 15 minutes	0	1	2	3	4
14	Waiting for 15 minutes in a plane on the ground with the door closed	0	1	2	3	4
15	Locked in a small DARK room without windows for 15 minutes	0	1	2	3	4
16	Locked in s small WELL-LIT room with windows for 15 minutes	0	1	2	3	4
17	Handcuffed for 15 minutes	0	1	2	3	4
18 *	Tied up with hands behind back for 15 minutes	0	1	2	3	4
19	Caught in tight clothing and unable to remove it	0	1	2	3	4
20 *	Standing for 15 minutes in a straight jacket	0	1	2	3	4
21	Lying in a tight sleeping bag enclosing legs and arms, tied at the neck, unable to get out for 15 minutes	0	1	2	3	4
22	Head first into a zipped up sleeping bag, able to leave whenever you wish	0	1	2	3	4
23	Lying in the trunk of a car with air flowing through freely for 15 minutes	0	1	2	3	4
24 *	Having your legs tied to an immovable chair	0	1	2	3	4
25	In a public washroom and the lock jams	0	1	2	3	4
26	In a crowded train which stops between stations	0	1	2	3	4

Ethics

As this study did not use NHS patients, full NHS ethical review was not required. However the study conformed to the University of Cumbria ethical guidance on research involving human subjects.

Statistics

Given that the data was ordinal and that we were looking for differences between those that were able to complete the MRI examination and those that could not, Mann Whitney U was used to analyse the results.

Results

Figure 1 – Average fear of suffocation scores as demonstrated by the CLQ

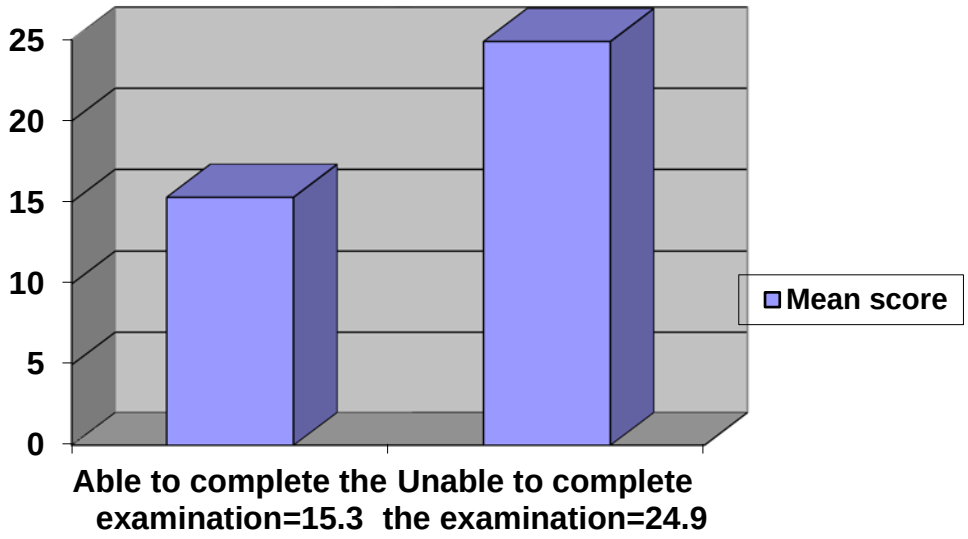


Figure 2 – Fear of restriction scores as demonstrated by the CLQ

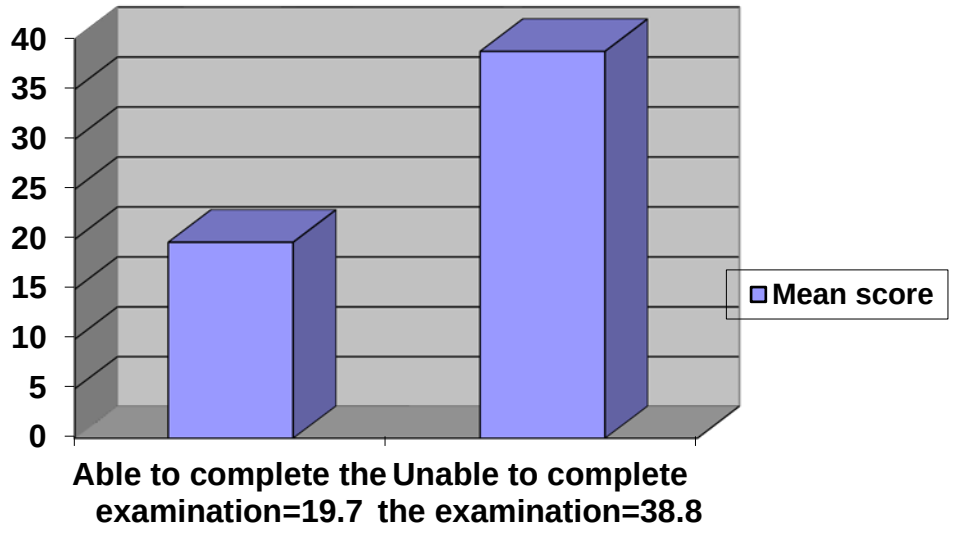
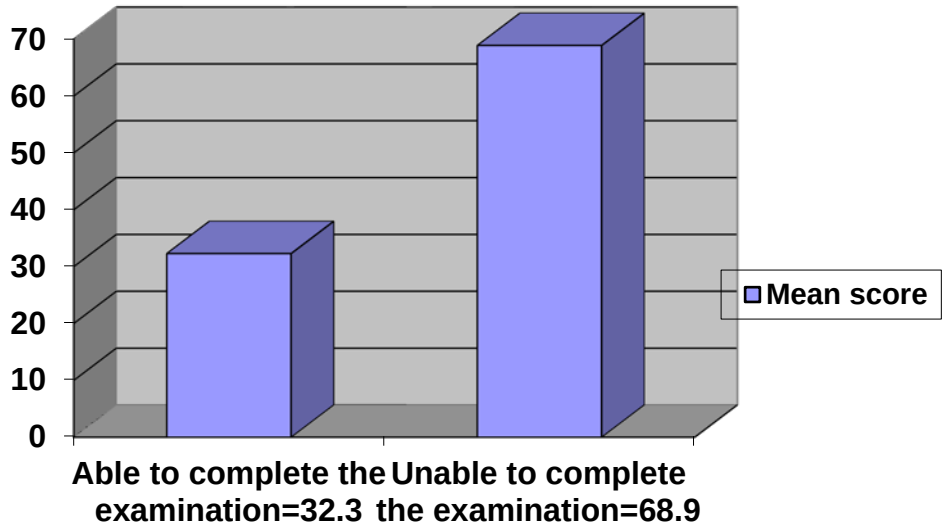


Figure 3 – Total mean scores as demonstrated by the CLQ



A significant difference was found between both groups total scores, the scores for a fear of restriction and the scores for a fear of suffocation to a level of 5%. The results therefore demonstrate that the CLQ could be a useful tool for predicting a patient's early termination of MRI examinations.

Discussion

MRI is the investigation of choice for a number of pathologies and although recent advances in MRI technology e.g. shorter/wider bores has meant that there may be fewer failed examinations due to claustrophobia (Murphy and Brunberg 1997) it is still apparent in the literature that significant costs are still associated with non-adherence in MRI. Failed examinations lead to wasted appointment slots, which in turn leads to an increase in waiting times for other patients. Although many interventions have been suggested in the literature to enable patients to complete the MRI scan on the first attempt it is apparent that these are not routinely used in practice. A more favoured approach is for patients to attempt the scan and if they do not succeed they are referred back to the consultant, either for sedation (it should be noted that GA sedation increases the costs of an MRI scan from £151 to £488 as estimated by Bigley et al (2009), which is in addition to the money wasted on the initial appointment), with its inherent risk or for another, more invasive intervention. It is also apparent from the literature that long term psychological morbidity is associated with MRI scans in some patients whose claustrophobia/anxiety has not been managed effectively prior to the procedure.

It would seem sensible therefore to identify and manage patients who might be claustrophobic prior to attendance with the ultimate aim of reducing costs and reducing a patient's long term psychological well-being.

Ultimately the question remains as to how these patients might be identified. This pilot study used the psychological test, known as the claustrophobia questionnaire with the aim of validating its use as a screening tool in MRI.

The results of the investigation suggest that that CLQ can differentiate between those patients who might not be able to complete an MRI examination and those that can. Nonetheless, shortcomings with the sample size make it difficult to generalise these findings to the population as a whole. The sample size is also too small to determine the full effectiveness of screening for claustrophobia using the CLQ as each sample group may have included patients who were not claustrophobic but could not complete the examination due to fears associated with diagnosis and those who are claustrophobic but could complete the examination. There is certainly evidence of at least one example of this in our results, where a patient who was unable to complete the examination actually scored lowest on the CLQ. It is also apparent that we cannot at this stage predict a 'critical score' or threshold for those patients who will not be able to undergo the examination. The ranges of total scores for those able to complete the examination were between 5 and 77, whereas those unable to undergo the examination ranged between 7 and 95. Again a powered sample size might enable us to predict a 'critical score' in any future research studies undertaken. It might have also been interesting to determine any patterns in the sample that might be associated with claustrophobia e.g. being female, age etc. However as we did not collect any demographic information on the returned questionnaires it was not possible to undertake this analysis.

Despite the shortcomings of the research we feel that the results contribute to the body of knowledge around claustrophobia and MRI which, although an on-going issue, is not a widely published topic. We, like McIsaac et al (2001), have found that the CLQ is a valid predictor of claustrophobia in MRI and by demonstrating how closely related the fear of suffocation and fear of restriction scores are we can say with some confidence that a fear of suffocation is as contributory to the claustrophobic response in MRI as perhaps the more obvious contributing fear of restriction, as suggested by Rachman and Taylor in 1993.

For this reason we feel that further research using the CLQ in MRI is warranted, not least one that includes a powered sample size. The aim of such research should be to identify 'critical scores', 'at risk' groups and to give validity to a mini-screening tool that reduces the number of questions on the questionnaire as suggested by McIssacs et al (2001).

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