RESEARCH ARTICLE

A Preliminary Investigation of Cast Anxiety in General Orthopaedic Practice

Carlo Ross, BSc (Hons)[1]; Mohamad Alqubaisi, BSc, MD, MSC, PhD[1];
Anand Pillai, MB, BS, MS(Orth), MRCS Ed, FRCS (T&O), FICS[1]

Research performed at Manchester University Foundation Trust, Manchester, England, UK

Abstract

Background: Anxiety following casting is an unrecognised complication that results in frequent visits to fracture clinic in the UK. There is a paucity of research regarding this complication. Failure to recognise Cast Anxiety (CA) leads to increased visits, frequent cast changes and possible failure of treatment despite no objective problems with the cast. Prior research has suggested a possible link between CA and claustrophobia but lacks statistical evidence. The Diagnostic and Statistical Manual of Psychiatric Disorders (DSM-V) categorizes claustrophobia as a Specific Phobia (SP) and questionnaires for both claustrophobia and SP exist. As such, the main purpose of this study is to examine the statistical correlation between the SP Questionnaire and the Claustrophobia Questionnaire to identify if a link exists between CA and claustrophobia. The secondary goal is to develop a screening questionnaire to identify those at high risk of CA, the significance of which lies in possible prevention of failure of surgical treatment and frequent visits to fracture clinic.

Methods: Self-report questionnaires were distributed to patients attending fracture clinic and accident emergency for review/ cast application/ problems with the cast over a one month period, no preference between upper or lower limb casts. This group completed both self-report questionnaires (N=157). From this group, patients were identified as having CA if they required frequent cast changes and frequent visits to fracture clinic despite no objective problems with the cast, or had themselves described feelings of anxiety/ claustrophobia. Follow up interviews with patients identified as having CA were undertaken. On the basis of the data gathered, a screening questionnaire was developed and distributed to a second group of patients with the same inclusion and exclusion criteria (N=50).

Results: A correlation between the two questionnaires was found: N= 157, r= 0.522, *P<0.001*. Three themes were identified as encompassing CA: Anxiety, Cognition and Physiological responses and Behaviour, evidencing an anxiety based disorder. The screening questionnaire identified over 80% of patients suffering from CA when scoring > 20/26. *Any patient scoring = 20/26 should be considered high risk of CA.

Conclusion: Based on this data, CA fits the criteria of an anxiety based condition. The modified screening tool permits early identification of individuals at high risk of CA. Usage of the screening tool is encouraged prior to casting and for future research modifications. Early identification will allow consideration of an alternative treatment option, anticipatory conversation and could prevent the failure of treatment.

Level of evidence: II

Keywords: Anxiety, Cast, Trauma

Introduction

Cast Anxiety (CA) is one of the most poorly understood phenomenon in routine orthopaedic practice despite the presence of the condition in trauma clinics daily. Patients with CA present with insufferable tightness, inordinate anxiety or intolerance to their applied casts in the absence of objective findings on cast removal.

Corresponding Author: Carlo Ross, Manchester University NHS Foundation Trust, Manchester, England, UK
Email: carlokeenanross@gmail.com

Tampering with casts has been documented, prompting further research aimed at investigating the management of CA in claustrophobic patients (1, 2). A Specific Phobia (SP) is categorised by DSM-V as an intense fear or anxiety in response to a stimuli- including medical procedures such as casting. CA is a SP and failure to recognise this SP leads to increased anxiety, the aforementioned presentation and even failure of treatment, making screening for CA a necessity.

Patients may complain of pain, feeling trapped, excessive rubbing or tightness, panic attacks, anxiety and even having had thoughts of, or actually manipulating the cast-ranging from loosening the cast to complete removal. This typically presents one day to two weeks post cast application (1, 2). Possible treatment measures include anticipatory conversation prior to cast application, using a removable splint in place of a cast, cognitive behavioural therapy and anxiolytic medication (1-5). Prior research suggests a possible link between CA and claustrophobia, recommending a claustrophobia screening tool but noted the cumbersome nature of the current Claustrophobia Questionnaire (CQ) (1, 2, 6). However, the evidence that CA is linked or due to claustrophobia is circumstantial. Nagura *et al.* claim to be developing a clinical questionnaire, however, one must determine if the CQ can identify individuals with CA firstly, and what the root cause of CA is, before attempting to generate a simplified version of a pre-existing CQ. Furthermore, DSM-V categories claustrophobia as a SP, and a SP severity measure questionnaire, of only 10 questions, exists (7). This would address the cumbersome nature of the CQ.

Psychometric evaluation of the CQ reveals high internal consistency, test-retest reliability and cut off-points indicative of claustrophobia (6). The CQ has strong discriminant validity with scores differing positively between normal and claustrophobic patients (8). Radomsky *et al.* encourage the use of the CQ as a screening tool in medical procedures (6). The American Psychiatric Association has created a Severity Measure Questionnaire for Specific Phobia. Prior research outlined the cumbersome nature of the CQ, however, failed to identify the existence of a SP questionnaire. No research has applied this SP questionnaire despite claustrophobia being a SP.

The gap in research surrounding CA is identifiable and has lead to the principle aims of this study: 1) to examine the statistical correlation between the CQ and the SP questionnaire in order to determine the root cause of this condition, 2) to examine patient experience of those with CA and 3) on the basis of these findings, develop a simplified screening questionnaire to identify individuals at high risk of CA and begin its validation.

Materials and Methods

This prospective study was conducted between 9 May 2018 and 6 June 2018 at Manchester University NHS Foundation Trust Fracture Clinic and Accident and Emergency. Self-report questionnaires were distributed to patients attending for cast review/ cast application/ problems with the cast, regardless of age, race, gender and extremity casted (N=157).

Inclusion criteria of the study required fracture of upper or lower limb treated with casting. Exclusion criteria included anxiety of casting secondary to an objective cause, for example, infection, bleeding, tightness of cast and neurological symptoms.

Other than the casted extremity, the information is self reported. Data on age, gender and post code in correlation with the Index of Multiple Deprivation was included to identify potential confounding effects.

From this group, patients were identified as having CA if they met the DSM-V criteria for SP. Practically this was evidenced as required frequent cast changes and frequent visits to fracture clinic despite no objective problems with the cast, or had themselves described feelings of anxiety/ claustrophobia (N=9). Interviews with patients identified as having CA were conducted, transcribed and subject to Thematic Analysis.

Following data collection, both the self-report questionnaires and the transcribed interviews with patients identified as having CA were analysed to generate a modified screening questionnaire. This was distributed to a second group of patients, with the same inclusion and exclusion criteria as the first group. Follow up interviews were conducted as before (N=50). In total, 207 patients were involved in this study.

Materials

The CQ comprises of 26 scenarios in which the patient ranks how anxious they would feel in each. Each scenario uses a five-point ordinal response and total scores range from zero to 104. A cut-off point indicative of a high risk of a claustrophobic event has been generated through psychometric analysis of the CQ were normative data generated a mean of 51.8 ((SD) of 16.6). Individuals scoring at or above 51.8 were considered claustrophobic (6, 8).

The SP questionnaire is created by the American Psychiatric Association and consists of 10 questions relating to one SP the patient has picked upon which to base the questions. The rationale for using this questionnaire is two-fold: 1) claustrophobia is a SP, and, 2) as the 26-question CQ is cumbersome. Each question uses a five-point ordinal response and total scores range from zero to 10. The total score is then divided by ten (the number of questions). There is no specific cut off point, rather, the clinician views the scores in relation to how high the anxiety is for that phobia; none= 0, mild= 1, moderate= 2, severe= 3, extreme= 4.

Statistical Analysis

Descriptive statistics such as means, standard deviations and percentages were used to describe the patients. Comparisons between the questionnaires was done in a continuous manner using Pearson's (r). Thematic Analysis (TA) was used to analyse the qualitative data (9). All analyses were conducted using SPSS version 22. Statistical significance was assessed using a nominal $P = 0.05$.

Results

The average age of patients that completed the

questionnaires was 46-years, SD 18.8, range: 12-92. The gender was approximately equal (53% responses from males and 47% from females). 57% of patients had an upper limb (UL) cast and 43% had a lower limb (LL) cast.

A correlation between the two questionnaires was identified: N= 157, r= 0.522, *P<0.001* [Figure 1]. Clinically, 9 patients (4 f, 5 m) were identified as having CA. These patients were identified as having CA due to frequent visits and cast modifications in the absence of objective cast problems and/or the expression of feelings of anxiety, claustrophobia or impact on mental health present only since casting. The mean age of the patients with CA was 57-years, SD 14.4, range: 35-79. 5 of these patients had UL casts and 4 LL casts. For these patients, the mean CQ score was 41. The mean SP questionnaire score was 11.

Each patient's CQ was studied to identify any common scenarios which these patients with this phenomenon found as anxiety provoking. Eight out of nine patients with CA found seven of the scenarios in the CQ anxiety provoking: Scenario 15 (Locked in a small DARK room without windows for 15 min), Scenario 17 (Handcuffed for 15 min), Scenario 18 (Tied with hands behind back for 15 min), Scenario 19 (Caught in tight clothing and unable to remove it), Scenario 20 (Standing for 15 min in a straight jacket), Scenario 23 (Lying in the trunk of a car with air flowing through freely for 15 min) and Scenario 24 (Having your legs tied to an immoveable chair) [Table 1].

Eight out of nine patients with CA found two of the scenarios in the CQ not anxiety provoking: Scenario one (Swimming while wearing a nose plug) and Scenario eight (Lying on the bottom bunk bed). Seven out of nine patients with CI found a further two of the scenarios not anxiety provoking: Scenario 11 (Working under a car for 15 min) and Scenario 13 (Lying in a sauna for 15 min).

Postcodes of the patients that completed the questionnaire were correlated with the International Measure of Deprivation (IMD). Of the 157 patients that completed the questionnaire, 54% had an IMD of 5 or below. Of the nine patients that were identified as experiencing CA, 78% had an IMD of five or below. Of this 78%, 57% had an IMD of one (the most deprived).

On the basis of TA, CA has three themes; Anxiety (which related to statements of feeling very anxious, all in the mind, wishing they could take it off), Cognition (which related to feelings of being trapped) and Physiological Responses and Behaviour (which related to self-manipulation of the cast and sensory symptoms).
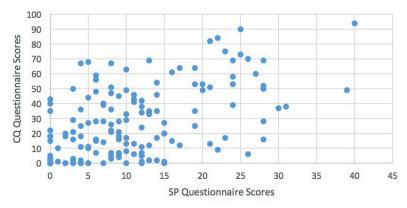
TA was performed on four out of six questions asked

Figure 1. Correlation between CQ and SP Questionnaire.

Table 1. Breakdown of the most frequent responses in the CQ for those with cast anxiety				
Scenario	Proportion of patients having no anxiety	Proportion of patients slightly anxious	Proportion of patients moderately anxious	Proportion of patients very anxious	Proportion of patients extremely anxious
15	1/9	2/9	1/9	2/9	3/9
17	1/9	2/9	1/9	3/9	2/9
18	1/9	2/9	0/9	2/9	4/9
19	1/9	1/9	3/9	3/9	1/9
20	1/9	2/9	1/9	1/9	4/9
23	1/9	2/9	1/9	1/9	4/9
24	1/9	0/9	3/9	1/9	4/9

Part 1

For each hypothetical scenario, please tick how anxious you would be in each.

	Scenario	Not at all	Mild	Moderate	Severe
1.	Tied with hands behind back for 15 min	☐ 0	☐ 1	☐ 2	☐ 3
2.	Standing for 15 min in a straight jacket	☐ 0	☐ 1	☐ 2	☐ 3
3.	Lying in the boot of a car with air flowing through freely for 15 min	☐ 0	☐ 1	☐ 2	☐ 3
4.	Having your legs tied to an immoveable chair	☐ 0	☐ 1	☐ 2	☐ 3
5.	Locked in a small DARK room without windows for 15 min	☐ 0	☐ 1	☐ 2	☐ 3
6.	Handcuffed for 15 min	☐ 0	☐ 1	☐ 2	☐ 3
7.	Caught in tight clothing and unable to remove it	☐ 0	☐ 1	☐ 2	☐ 3

Part 2

1. If you have ever felt trapped in a situation were you... (tick all that apply)?

- afraid that something terrible would happen to you?

Yes ☐
No ☐

- worried that you would never get out?

Yes ☐
No ☐

2. If you have ever felt anxious, did you.... (tick all that apply)

Yes ☐
No ☐

- feel agitated or pace up and down?

Yes ☐
No ☐

- try to escape the situation?

Yes ☐
No ☐

- Feel your heart racing, stomach churn, sweaty, trouble breathing or faint?

Yes ☐
No ☐

Figure 2. Screening Questionnaire for Cast Anxiety.

in interviews. The two remaining questions were yes no answers. 44% of patients considered themselves to be claustrophobic. 11% patients had a current or previous mental health condition ((This was Post Traumatic Stress Disorder (PTSD)).

On the basis of this data, a screening questionnaire was developed and distributed to a similar cohort which were then also subject to interviews [Figure 2]. The modified screening questionnaire identified over 80% of patients with CA when scoring > 20/26. Any patient scoring > 20/26 should be considered high risk of suffering from CA.

Discussion

Failure to recognise CA has a multitude of consequences ranging from frequent cast changes, psychological distress and even tampering of the cast leading to failed treatment (1, 2). A positive correlation between the CQ and the SP questionnaire was identified, which is statistically significant. Three themes encompass CA; Anxiety, Cognition and Physiological responses and Behaviour. These themes identically match the cognitive behavioural model of anxiety as well as the diagnostic criteria of SP in DSM-V [Figure 3] (7, 10). This evidences that CA is an anxiety based disorder rather
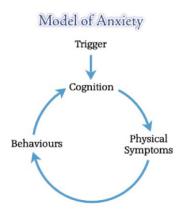
Figure 3. Model of Anxiety.

than claustrophobia. For this condition, the cast is the trigger which leads to the cycle of anxiety, cognition and physiological responses and behaviour.

Anxiety correlates with reduced health status, significantly decreased health related quality of life as well as more frequent use of health services (11-14). On the basis of this data, a modified screening tool was developed in the hope of reducing possible psychological distress, repeated hospital visits and failure of treatment.

Although a relatively small number of patients were identified as having CA, it is worth noting that this is comparable to prior studies in to this phenomenon. However, this study is over a one month period and the impact upon patient psychological health and surgical outcomes as well as the financial costs of repeated visits, cast modifications and possible failure of treatment requiring surgical revision should not be ignored.

Alternative explanations include that some individuals simply do not like casts and that perhaps this phenomenon is a manifestation of previous or current mental illness. The statistically significant positive correlation between the CQ and SP questionnaire is the first piece of evidence that this is an anxiety based disorder and more than simply 'not liking a cast'. Moreover, the the primary themes identified; Anxiety, Cognition and Physiological responses and Behaviour match perfectly with the cognitive behavioural model of anxiety [Figure 3] (10). Only one out of nine patients identified as having CA had a current or previous mental health condition. This is further against the latter alternative explanation of these findings.

The mean age of individuals experiencing psychological difficulties to casting in our study (57-years-old [range: 35-79, SD 14.4]) is slightly higher compared to prior research (44-years-old [range: 31-46]) (1). In prior research, five females and eight males had CA which is comparable to our study where four females and five males were identified (1, 2). It would appear that slightly more men suffer from this phenomenon, however, this finding requires further study. In our study, five patients

with this intolerance had an UL cast, four had a LL cast.

This contrasts to prior research were all cases reported involved UL casts. No prior research has detailed this phenomenon occurring in LL casting, rather, both have detailed the occurrence of this being rare (1, 2). Inherently, prior research was biased focussing solely on UL casts. Failure of prior research to explore CA in LL cast answers this discrepancy of results. Of the nine patients experiencing psychological difficulties to casting in our study, three out of nine had LL casts. Of these, two of these patients were noted as having extreme difficulties with casting. One patient described the experience as "being in a prison cell with an open door but you can't get out because something is stopping you." This patient had seven cast changes and eventually removed the cast themselves. Another patient described the experience as all being "in my head". This patient required several cast modifications and eventually removed the cast themselves. Although no qualitative study exists from prior research, Lanigan *et al.* case report did detail patients having described the experience as being "trapped" and that "I was locked in a prison cell" (2). There would appear to be a level agreement between our qualitative data and the previously reported experiences of other patients. Further research is encouraged to study both the qualitative nature of this phenomenon as well as its occurrence in LL casts.

Of the 157 patients that completed the questionnaire, 54% had an IMD of 5 or below. Of the nine patients that were identified as experiencing psychological difficulties associated with casting, 78% had an IMD of five or below. Of this 78%, 57% had an IMD of one (the most deprived). This finding suggests that there may be a link between deprivation and CA, however, this requires further consideration in future research.

44% of patients identified themselves as claustrophobic. In Nagura *et al.* research, 78% were aware of their claustrophobia (1). In Lanigan *et al.* case report, 25% were aware of their claustrophobia prior to casting (2). On the basis of our study, we have concluded that asking a patient if they considered themselves claustrophobic as a possible screening tool would not be appropriate, despite prior suggestion it would be so (2). Furthermore, only patient had a current or previous mental health illness. Therefore, it would also be inappropriate to inquire about current or previous mental health illness as a means of screening for this phenomenon.

Weakness of this study include: the questionnaires were difficult to administer as in total 36 questions needed to be answered; The CQ can have varying responses depending on who the patient perceives the scenario to be from. For example, Scenario 17 (Handcuffed for 15 min): how anxious a patient would feel greatly depends on if they perceive a friend to be the one handcuffing them or the police. To address this limitation, a suggestion would be to explain in few sentences above the questionnaire that for the patient to imagine these hypothetical scenarios in a safe environment. This would perhaps reduce any false positives.

Furthermore, there is a relatively small sample size and

generally, there is an issue with questionnaires were there is the potential for bias in 'faking good' and 'faking bad' (15). Finally, both the qualitative interviews and analysis of the interviews are also potentially open to bias.

This is the first study to examine the quantitative and qualitative nature of CA and extends the literature in several ways. Both the quantitative and qualitative stem of this study suggest that this is an anxiety based phenomenon. On the basis of this study, a screening tool has been developed with its initial results being promising [Figure 2]. It is recommended to examine the utility of this screening tool in routine orthopaedic practice. Early identification of this phenomenon will reduce psychological distress, the need for frequent cast modifications and even prevent failed treatment.

Carlo Ross BSc (Hons)[1]
Mohamad Alqubaisi BSc MD MSC PhD[1]
Anand Pillai MB BS MS(Orth) MRCS Ed FRCS (T&O) FICS[1]
1 Manchester University NHS Foundation Trust, Manchester, England, UK

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