

Investigating quality of life in people with Charcot neuroarthropathy

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Citation: Srivastava S, Younis N, Kurdy N (2016) Investigating quality of life in people with Charcot neuroarthropathy. *The Diabetic Foot Journal* 19: 70–4

Article points

1. This study used the SF-36 questionnaire to compare quality of life regarding physical and mental health in participants with diabetes alone, diabetes and neuropathy and diabetes and Charcot neuroarthropathy.
2. The patients with Charcot neuroarthropathy in the study had lower quality of life regarding physical and mental health.
3. Women and those with a higher BMI who had Charcot arthropathy had a lower mental health scores than the other participants with the condition.

Key words

- Charcot arthropathy
- Diabetes
- Quality of life

Authors

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This study aims to establish whether people with Charcot neuroarthropathy as a complication of diabetes have a reduced quality of life compared with people with diabetes who have peripheral neuropathy alone or those without any foot disease. The study also investigates if any other demographic variables such as age, gender, body mass index, type of diabetes and diabetic control are associated with poorer quality of life in patients with the condition. A total of 118 patients were included in the study and quality of life was assessed using the SF-36 questionnaire. Physical health was significantly reduced in patients with Charcot neuroarthropathy compared with the other groups. Mental health was also significantly reduced in patients with Charcot neuroarthropathy. Women with the condition had poorer mental health quality of life than the men and a high body mass index was associated with poorer mental health in those patients with Charcot neuroarthropathy.

Charcot neuroarthropathy is one of the many complications of diabetes. It is a syndrome occurring in patients with diabetic neuropathy, which results in progressive destruction and deformity of joints, particularly in the foot and ankle. Current literature states that quality of life regarding physical health is reduced in patients with Charcot neuroarthropathy when compared with controls (Eichenholtz, 1966; Pinzur and Evans, 2003; Dhawan et al, 2005; Sochocki et al, 2008; Rasovic and Wukich 2014) but there is a lack of long-term data available that supports this. There is also a lack of data concerning the effects of Charcot neuroarthropathy on people's mental health.

This study aims to establish if patients with Charcot neuroarthropathy have reduced quality of life with respect to physical and mental health compared with people with diabetes and no neuropathy and people with diabetes and peripheral neuropathy alone. The study also aims to identify whether there are any other demographic variables such as age, gender, body mass index, type of diabetes and HbA_{1c} which are associated with poorer quality of life for these patients.

Method

This study was carried out at the University Hospital of South Manchester in the diabetes and orthopaedic departments between May and July 2014.

The aims of this study were:

- To establish whether patients with Charcot neuroarthropathy have reduced quality of life compared with those with only neuropathy and with subjects with diabetes but no foot disease.
- To identify whether any other demographic data is associated with poorer quality of life in patients with Charcot neuroarthropathy, such as age, gender, BMI, type of diabetes and the most current recorded HbA_{1c} levels.

Short-form health survey (SF-36) questionnaires, which is a tool used to measure aspects of quality of life were given to 140 patients who had diabetes of which 22 did not complete the questionnaire and hence were excluded. The patients were selected from general diabetes clinics running in University Hospital of South Manchester, Withington Community Hospital and the Forum Health Centre in Manchester. The patients were not selected specifically based on age or pathology. A total of 118 patients were included of which 64 were patients with diabetic foot complications and 54 were

patients who had diabetes with no foot problems. Of the patients with foot complications, 39 had Charcot neuroarthropathy and 25 had neuropathy alone. Patients were asked to complete the SF-36 questionnaire at clinics held at Withington Community Hospital and the Forum health centre.

The questionnaires were then collated and individually assessed using the online SF-36 scoring system to produce two summary scores: the physical component summary (PCS) and the mental component summary (MCS).

Each questionnaire was scored for both mental and physical health as a percentage, with 0 being maximum disability and 100 being no disability. Additional patient information including age, gender, BMI and diabetes type noted from individual case notes. The most recent HbA_{1c} (measured in the previous six months) was either taken from the case notes or the hospital computer records. Patients were grouped according to their foot complications: those with Charcot neuroarthropathy identified by a formal diagnosis in their notes; those with peripheral neuropathy grouped according to clinical signs of the condition; and those who had no sign of foot disease.

All the collated data was then transferred into a database ready for analysis using Stats Direct. In order to compare the mean MCS and PCS scores across the three subject groups a one-way ANOVA test was carried out. In order to assess if the type of diabetes and gender were associated with reduced quality of life in patients with Charcot neuroarthropathy an unpaired t-test was performed. In order to assess if age, BMI or HbA_{1c} are associated with reduced quality of life in patients with Charcot neuroarthropathy, a simple linear regression analysis was carried out.

Results

Thirty-nine patients were in the Charcot neuroarthropathy group, 25 in the peripheral neuropathy group and 54 were in the diabetes-only group. The demographic data of the three groups are reported in *Table 1*. There were more men included in this study than women and more patients had type 2 diabetes. There were more men (74) included in this study than women (44) and more patients with type 2 diabetes mellitus (91) as compared to those with type 1 diabetes mellitus (27).

Additionally there was a significant difference in the age of the subjects in the Charcot group compared

with the neuropathy group (<0.0001) as shown in *Table 2*.

Quality of life

Patients with Charcot neuroarthropathy reported mean SF-36 PCS and MCS scores that were lower than the participants with peripheral neuropathy and those with diabetes only (*Figure 1*). Control subjects reported the highest mean SF-36 PCS and MCS scores across the three groups (*Figure 1*). In order to identify if the difference was significantly different, a one-way ANOVA test was carried out for the PCS scores first followed by multiple comparisons.

It was identified that the reported physical quality of life outcomes in patients with Charcot neuroarthropathy were significantly poorer when compared with patients with peripheral neuropathy as well as control patients ($p<0.001$). The mean PCS scores in patients with neuropathy compared with control subjects was not significantly different ($p>0.05$). Additionally the mean PCS in patients with neuropathy compared with Charcot was not significantly different ($p>0.05$).

The same analyses were then performed on the MCS scores across the three groups. The mean MCS scores in patients with Charcot compared

Table 1. Distribution of gender and diabetes type among participants.

| | Charcot neuroarthropathy group (n=39) | Peripheral neuropathy group (n=25) | Diabetes-only group (n=54) |
|------------------------|---------------------------------------|------------------------------------|----------------------------|
| Men | 26 | 17 | 31 |
| Women | 13 | 8 | 23 |
| Diabetes type 1/type 2 | 10/29 | 5/20 | 12/42 |

Table 2. Mean age, BMI and HbA_{1c} of patients across the participants.

| | Charcot group (n=39) | Peripheral neuropathy (n=25) | Diabetes-only (n=54) | p Charcot and neuropathy | p Charcot and controls | p neuropathy and controls |
|---------------------------------|----------------------|------------------------------|----------------------|----------------------------|--------------------------|-----------------------------|
| Mean age (years) \pm SD | 61 \pm 13 | 49 \pm 12 | 56 \pm 16 | <0.0001 | >0.05 | >0.05 |
| Mean BMI (kg/m ²) | 30.7 | 30.6 | 31.5 | >0.05 | >0.05 | >0.05 |
| Mean HbA _{1c} mmol/mol | 67.5 | 71.4 | 68.3 | >0.05 | >0.05 | >0.05 |

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with control subjects were significantly different ($p < 0.05$). This means that the reported quality of life regarding mental health in patients with Charcot neuroarthropathy was significantly poorer than in patients with peripheral neuropathy alone and in the control subjects. The mean MCS score in patients with neuropathy compared with control subjects was not significantly different ($p > 0.05$). Additionally the mean MCS in patients with neuropathy alone compared with Charcot was not significantly different ($p > 0.05$).

Gender

The mean PCS score for women was 30.6 ($n = 13$) and in men it was 35 ($n = 26$). There was no statistically significant difference between PCS scores between the men and the women ($p > 0.05$). The mean MCS score in women was 33 ($n = 13$) and in men it was 44 ($n = 26$). These results identify that the women with Charcot in the study reported lower mental health quality of life compared with men with Charcot ($p < 0.05$).

Type of diabetes

The mean PCS score in participants with type 1 diabetes and Charcot neuroarthropathy was 32.3 ($n = 10$) and in people with type 2 diabetes and Charcot it was 34 ($n = 29$). The mean MCS score in the type 1 group was 43.5 ($n = 10$) and in type 2 it was 40 ($n = 29$). These results identify that there was no association between diabetes type and the quality of life in the participants with Charcot.

Age

There was no significant correlation between increasing age and PCS or MCS scores in the group with Charcot neuroarthropathy ($p > 0.05$).

BMI

There was no significant correlation between increasing BMI and the PCS scores in the Charcot group ($p > 0.05$). The correlation coefficient was -0.17 . Interestingly, linear regression analysis reported that there was a significant correlation between increasing BMI and lower MCS scores in the Charcot group ($p < 0.05$). However, the correlation coefficient was not as strong as we anticipated (-0.43). This suggests that there is a weak correlation between increasing BMI and poorer mental health quality of life outcomes in patients with Charcot neuroarthropathy (Figure 2). Additionally no link was found between BMI and physical quality of life in the participants with Charcot neuroarthropathy (Figure 3).

HbA_{1c}

There was no significant correlation between poorly controlled HbA_{1c} and lower PCS or MCS scores in the Charcot group ($p > 0.05$); in diabetic patients, the aim is for the HbA_{1c} to be $< 6.5\%$ (48 mmol/mol). These findings suggest that there is no association between the most recent HbA_{1c} levels and quality of life in the participants with Charcot.

Results summary

- Physical quality of life was reported to be poorer in patients with Charcot neuroarthropathy compared with the other groups.
- Mental health quality of life was reported to be poorer in patients with Charcot neuroarthropathy compared with the other groups.
- Women with Charcot neuroarthropathy reported having a poorer mental health quality of life than men with Charcot neuroarthropathy.
- A higher BMI in the participants with Charcot neuroarthropathy was associated with poorer mental health quality of life outcomes, but not physical health outcomes.

Discussion

The reduced quality of life related to physical health for people with Charcot neuroarthropathy identified in this study is consistent with evidence in the literature

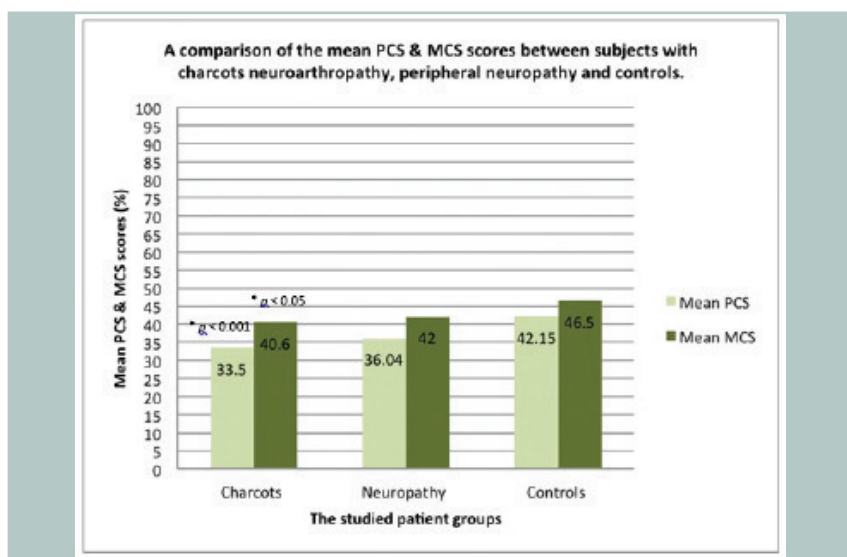


Figure 1. A comparison of the mean PCS and MCS scores.

(Eichenholtz 1966; Pinzur and Evans 2003; Dhawan et al, 2005; Sochocki et al, 2008; Raspovic and Wukich, 2014). It suggests the need for appropriate screening for physical quality of life at regular intervals in those with the condition and the need for a subsequent review at a diabetes clinic or with their GP.

The findings also suggest that the mental health quality of life was also significantly reduced in patients with Charcot neuroarthropathy. In particular that women with Charcot have poorer mental health than men with the condition. These findings are consistent with a study that reported high levels of mental health problems particularly in women with Charcot neuroarthropathy (Chapman et al, 2014). These findings also suggest the need to screen for common mental health problems such as anxiety and depression in people with diabetes with Charcot as mental health co-morbidities are associated with poor self-care, which potentially could affect treatment efficacy and prognosis. The SF-36 questionnaire could be used however there are two more widely used screening tools in the UK, which are the Hospital Anxiety and Depression Scale (HADS) and the Patient Health Questionnaire (PHQ). Use of either must be consistent. As previously suggested with respect to screening for physical health, a similar system could be adopted for mental health in order to identify patients that need review.

In the literature it has been reported that being overweight and obese are also associated with poorer physical quality of life outcomes (Katz et al, 2000; Jia and Lubetkin, 2005). It is also suggested that although increasing BMI mainly affects the physical quality of life, the emotional component of mental health is also significantly affected (Anandacoomarasamy et al, 2009). This study suggests that patients who have Charcot neuroarthropathy and a higher BMI do not have poorer physical quality of life, instead they were found to have poorer mental health.

The findings also report that there is no significant association between quality of life and age, most current HbA_{1c} and the type of diabetes. The results associated with HbA_{1c} and quality of life are perhaps most interesting as this is a modifiable variable. Further studies are needed to collate further data for each patient perhaps using a series of HbA_{1c} measurements from diagnosis onwards. This will help clarify if there is an association with blood glucose control and quality of life outcomes.

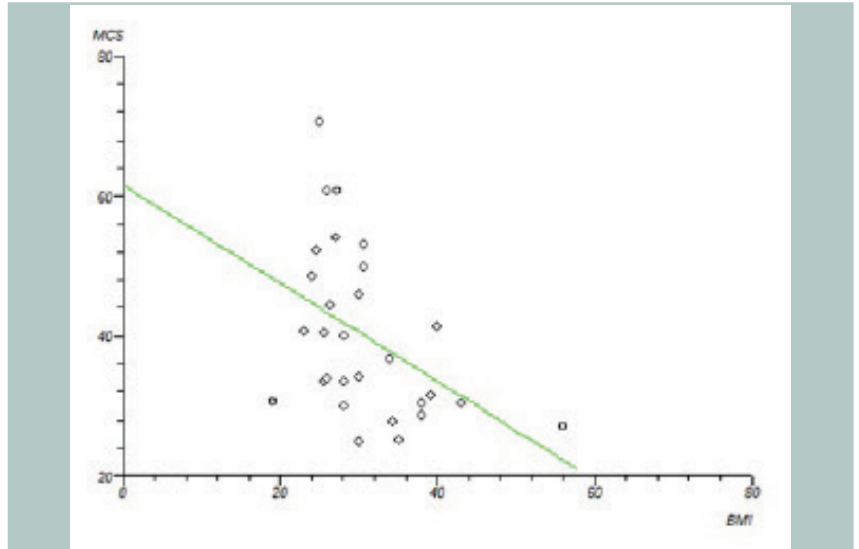


Figure 2. A scatter graph demonstrating that our results showed a weak correlation between increasing BMI and lower mental quality of life scores.study groups.

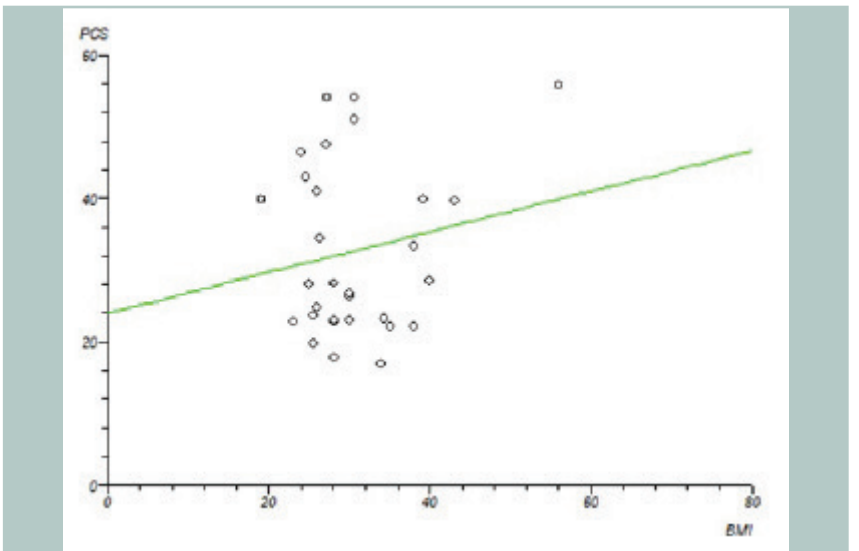


Figure 3. A scatter graph demonstrating that our results showed that there was no correlation between increasing BMI and lower physical quality of life scores.

Strengths of the study

- The size of the cohort included in this study enabled good quality statistical analysis.
- In comparison to the existing literature, this study included specific groups of patients from different stages of diabetic foot disease.
- The SF-36 questionnaire is a reliable general health questionnaire, which provides both a mental quality of life score and a physical quality of life score.
- The impact of a variety of patient demographics on

quality of life was assessed, as well as the impact of having foot disease.

Limitations of the study

- Significant results identified in the group with women may have been due to the smaller number of women compared with the men. The power of the subgroup analysis results may be limited due to small participant numbers.
- There was a significant difference in patient age between the Charcot group compared with the neuropathy group which may have influenced the results.
- The impact of other micro and macrovascular complications of diabetes, such as stroke, angina, chronic kidney disease, and socioeconomic factors were not evaluated. These can have a major impact on quality of life and given the older age of the Charcot group may have been more prevalent.
- Only the most recent HbA_{1c} measurements were analysed which may not be useful as a snapshot as it is an average blood glucose measurement and

a series of measurements may give a more accurate picture of the patient's status.

- Patients with more severe disease may not have participated in this study as they may have been admitted to hospital rather than being seen at the recruiting clinics.

Conclusion

Charcot neuroarthropathy is associated with significantly reduced quality of life with respect to mental and physical health. The results of this study show that patients with Charcot neuroarthropathy have reduced quality of life as measured by the SF-36 questionnaire compared with those with peripheral neuropathy alone and those with no foot complications. Women and those with higher BMI also had poorer quality of life regarding mental health among the participants with the condition. These are clinically significant findings indicating the need for specific quality of life screening in patients with Charcot neuroarthropathy, followed by appropriate follow up and interventions. ■



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