Diabetic osteoarthropathy care in Sweden – Need for improvement: A national inventory

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ABSTRACT

Aims: Osteoarthropathy, a rare foot complication in patients with diabetes mellitus, calls for immediate and optimal management to prevent irreversible bone/joint destruction and risk of amputation. Awareness of the condition and adequate guidelines would minimize the consequences and the costs, both for the patient and for the society. We investigated the diabetic osteoarthropathy care in Swedish orthopedic clinics.

Methods: A questionnaire was distributed to 63 Swedish hospitals with emergency department for orthopedic patients. There was a 95% response rate.

Results: Most of the respondents (79%) specified absence of established procedures including guidelines for managing patients with osteoarthropathy. The most common diagnostic method was clinical diagnosis and plain X-ray (95%). MRI or scintigraphy was used by 19% and 10.5% respectively. As treatment method, 84% used a total contact cast, while 38% used orthoses. Treatment duration <3 months was reported in 4%, 3–6 months in 53% and 6–12 months in 28% of the clinics. Four clinics reported treatment duration >12 months and two clinics provided no treatment.

Conclusion: Our national inventory indicates a need for improvement in knowledge as well as guidance and organization at orthopedic clinics regarding optimal care of patients with diabetic osteoarthropathy.

Introduction

Neuropathic foot arthropathy was first described in patients with tabes dorsalis by Jean-Marie Charcot in 1868 [1]. The association between osteoarthropathy and diabetes mellitus was presented by Jordan [2]. Despite the condition being known for such a long time the diagnostic and treatment options have been limited. However, the reconstruction techniques for unavoidable osteoarthropathy foot deformity have substantially improved during the 20th century [3].

The diagnosis of diabetic osteoarthropathy today is associated with already affected and fractured bones. This will require advanced reconstructive surgery including a long rehabilitation period with reduced mobility for the patient. Moreover, there will be a risk for amputation if the osteoarthropathy is complicated by chronic ulcers and/or chronic infections [4].

As the current diagnosis is based on plain X-ray findings with a destruction of the foot skeleton (Fig. 1a-b) the condition, to some extent, has already become too aggravated to heal without sequelae. New diagnostic methods facilitating earlier diagnosis is therefore imperative. More advanced diagnostic tools have been evaluated, with MRI (magnetic resonance imaging) emerging as highly sensitive for the early detection of osteoarthropathy. Unfortunately, due to the similarities with osteomyelitis, the specificity of MRI is unsatisfactory but MRI could probably be a valuable diagnostic alternative [5-7]. Bone scintigraphy is another imaging technique which shows a high sensitivity for bone pathology with increased uptake in patients with osteoarthropathy [8]. Impaired circulation can, however, result in a false-negative result and the uptake of the radionuclide tracers used is not specific for
osteoarthropathy [9]. Positron emission tomography (PET) scanning with 18F-FDG has been proposed as a possible diagnostic pathway [10,11]. However, more research is necessary before this technique can be applied in clinical practice.

There have been different pathophysiological models for osteoarthropathy. The original French theory is based on Charcot’s studies of ataxia and finds the cause of the condition in lesions in the spinal cord.

The German theory, as promoted by Volkman and Virchow, focuses on multiple traumas to the joints. The neurovascular theory which could be connected with the French suggests that a neurally initiated vascular reflex leads to activation of osteoclasts and thereby bone resorption and fragility of the bone [2]. However, none of these theories provide a comprehensive explanation for diabetes osteoarthropathy.

Recently the inflammatory role of the condition especially receptor activator of the nuclear factor kappa B ligand (RANKL), NF-κB and osteopotegerin (OPG) has been thoroughly discussed [12–14]. With better understanding of the inflammatory mechanisms new therapeutical options seems possible.

The current treatment is focused on an immediate reduction of the bone-altering effects of the inflammatory condition. This usually implies long treatment periods of total off-loading with casts/orthosis and with non-weight bearing regimes and a considerable risk of low compliance.

Although diabetic osteoarthropathy is a rare foot complication with an estimated incidence of 0, 8–8% [15] the impact for the patient will be a reduced quality of life [16–18] including anxiety and depression [19] and for the society substantial health economical costs [20].

The condition is by our experience overlooked and often missed- and/or late diagnosed and there is in Sweden currently no information available regarding the caregiving of this patient group.

The purpose of this study was to make a national inventory of orthopedic caregivers’ organization for the diagnosis and treatment of diabetic osteoarthropathy.

**Methods**

This descriptive and cross-sectional study was carried out during the spring and early summer of 2014. Based on a registry from the Swedish Association of Local Authorities and Regions (SKL), 73 hospitals with emergency departments for orthopedic patients were identified. Since 14 of the hospitals were so-called “joint
orthopedic clinics” with shared organizational structure, 63 units were chosen to investigate orthopedic caregiver’s organization for diagnosing and managing patients with suspected diabetic osteoarthropathy. The heads of the orthopedic clinics at each hospital were contacted to identify the orthopedic surgeon responsible for the care of patients with foot complications. The orthopedic surgeons were then contacted by e-mail with a description of the project’s purpose.

Data were collected using a structured questionnaire addressed directly to the orthopedic surgeon at each orthopedic clinic, requesting a response within 2 weeks. The questionnaire consisted of 8 questions mainly regarding diagnosis and treatment of patients with diabetic osteoarthropathy.

The respondents were also asked to include the clinic’s current guidelines for diabetic osteoarthropathy management when returning the questionnaire.

The responses received were compiled without identifying individual units because the questionnaires were coded. The data were downloaded into Microsoft Excel, and analyzed and computed in terms of frequencies and percentages using the Statistical Package for Social Sciences (SPSS) Windows version 22.0. The received guidelines were assessed using diabetic (Charcot) foot management directives from the American Academy of Orthopaedic Surgeons (AAOS).

Results

We received answers from 60 clinics representing a 95% response rate (60/63). Three respondents stated that they have never dealt with patients with diabetic osteoarthropathy and therefore the analysis is based on responses from 57 clinics.

The estimated annual number of patients with diabetic osteoarthropathy is presented in Fig. 2.

Two of the responding clinics stated that they did not know whether they had any established guidelines for managing patients with diabetic osteoarthropathy. Most of the respondents, 45 clinics (79%), said they had no guidelines. Ten clinics reported that they had guidelines and seven of those attached them to the questionnaire. Upon evaluating these guidelines, only two could attain the level of management procedures recommended by the AAOS [21].

Diagnosis

Fifty clinics used more than one method for diagnosing osteoarthropathy and the most common diagnostic methods were clinical diagnosis and plain X-ray (Fig. 3).

Treatment

As their treatment method, 17 of the clinics stated that they used different casting methods (Table 2), whereof 47 (84%) used a total contact cast and 21 (38%) orthosis. The most frequently used orthosis was the Aircast walker, at 27 institutions (47%). Six clinics (11%) also used individually adapted orthosis and in a few cases additional options were also specified such as the Don Joy Walker (2%), the Walker from Össur (2%) and PTB Orthosis (2%). Ten of the respondent clinics specified an orthosis option even though they had only listed the total contact cast as a treatment method.

Two clinics indicated a treatment duration of less than 3 months, thirty clinics (53%) a treatment duration of 3–6 months and sixteen clinics (28%) a duration of 6–12 months. Only four clinics indicated duration longer than 12 months, while two clinics provided no treatment at all.
The data derived from this study show that 34 of the 57 clinics claim to have access to reconstructive foot surgery for diabetic osteoarthropathy. Eleven referred the patient to the nearest university hospital and nine to the regional hospital. Two clinics stated that they did not know and one referred the patients to other unspecified clinics.

Discussion

To the best of our knowledge, there are currently no official reports at a national level on the prevalence of diabetic osteoarthropathy. However, it is likely that many cases are undiagnosed due to the health care system’s lack of recognition of the typical acute manifestation of diabetes osteoarthropathy [15]. Based on the data derived from our study, we can only estimate the number of patients managed annually at each orthopedic clinic.

When reviewing the few guidelines provided by participating clinics, the lack of scientific basis for the guidelines became evident. This absence of evidence-based recommendations may partly explain the absence of printed guidelines from the participating clinics. Nevertheless, the AAOS recommendations presented on their website seem widespread and emphasize early diagnosis, treatment with non-weight bearing casts and long periods of treatment [21]. Based on this information, we found that out of seven provided guidelines, only two can be considered acceptable. This observation of non-existing guidelines in Sweden is in accordance with a recently published Danish study [22]. Another recent study from Michigan, USA [23] also indicate the importance of education as well as need for guidelines about Charcot neuroarthropathy for referring providers and more efficient referral processes. It is also noteworthy that even the recommendation from the AAOS is somewhat controversial and, for instance, indicates a much shorter time of treatment than is recommended by others [24].

To avoid deformity, the early osteoarthropathy diagnosis is of utmost importance for initiation of treatment. If a radiological method should be used, the method must be able to detect the condition in the acute phase before any bone destruction. The data derived from this study show that plain radiography is the most used method even though it will not show the early pathological bone changes [25]. Instead, MRI could possibly be used to visualize subchondral bone marrow edema with or without microfractures [26–28].

Only six clinics stated that they used bone scintigraphy as a diagnostic method even though it has a high sensitivity for detection of diabetic osteoarthropathy. The specificity is, however, considered to be insufficient for the diagnosis of the condition [29]. A hybrid PET/CT technique (positron emission tomography combined with computed tomography) that provides both metabolic and structural information in one imaging session would contribute to the diagnosis of osteoarthropathy [30]. However, this method was not included as an alternative in the questionnaire because it is currently under evaluation and is not considered as a clinical routine in Swedish hospitals.

Another issue that could merit further discussion is the fact that we did not specifically ask for the policy regarding weight bearing/non-weight bearing off-loading. Treatment with casts could possibly indicate non-weight bearing and orthosis a more weight bearing solution. A high number of clinics answered that they use both cast and weight bearing (21%). An explanation for this answer could be that those clinics start with a non-weight-bearing, total contact cast and later change to an orthosis when possible weight bearing is allowed.

Regarding the question of the availability of reconstructive surgery at the home clinic, the reported number is surprisingly high (60%). One explanation for this result could be that surgeons responding to the questionnaire were not aware of the competence needed for this complicated reconstructive surgery. Even though there might be some general foot surgeons at the clinic, this does not necessarily mean that they could perform this kind of advanced surgery. They in turn may actually refer these patients to specific foot surgery departments, without the respondent being aware of it.

A weakness of our study is that the primary care physicians who might be the patient’s first health care contact were not part of the inventory. Our findings indicate the need for further assessment of the caregiving of these patients also at the primary care level. However, we believe that as diabetes osteoarthropathy is an orthopedic issue, especially when it comes to reconstructive surgery, it demands the highest and optimal mindset at the orthopedic clinic to reduce the consequences of this rather rare but devastating diabetic foot complication. The knowledge of the orthopedic clinics should then actively and regularly be transferred to the primary care level.

In summary, this inventory clearly indicates a national need for an improvement in knowledge as well as guidance and organization regarding the care of patients with diabetic osteoarthropathy, since only two of 63 clinics presented useful guidelines. We also advocate national inventories of the care of diabetic osteoarthropathy in all developed countries to create a more optimal and equal care for this rare but important foot complication in patients with diabetes. We strongly recommend a multidisciplinary and value based approach [31] to this diabetic foot complication in order to minimize the consequences for the patient and the costs for the society. In addition, we see a need for international consensus discussions in order to improve diagnosis and management of patients with suspected diabetic osteoarthropathy. An improved management will reduce the risk of foot deformity with less need of surgical reconstruction and risk for amputation.

Conflict of interest

No competing interest declared

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Contributions of authors

L.W. assisted with the study design, collected research data, conducted data analyses and wrote the manuscript. P.L. assisted with design of the questionnaire and data analyses and wrote part of the manuscript. R.A. and P.A. contributed to discussions and reviewed and edited the questionnaire and manuscript. K.G.A. reviewed and edited the manuscript. B.Å. designed the questionnaire, supervised the study and reviewed and edited the manuscript. L.W and P.L are the guarantors of this work and, as such, had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Conflict of interest

No competing interest declared
Appendix A

1) Approximately how many patients with diabetic osteoarthropathy are handled annually at your clinic?

|   | 0 | 1-5 | 6-10 | > 10 | Do not know |
|---|---|-----|------|------|-------------|
|   |   |     |      |      |             |

2) Does the clinic have current guidelines for the management of diabetic osteoarthropathy?

(Please send guidelines together with survey.)

|   | Yes | No | Do not know |
|---|-----|----|-------------|
|   |     |    |             |

3) What methodology is used to diagnose diabetic osteoarthropathy at your clinic?

- Clinical diagnosis
- Skin temperature
- Conventional plain radiography
- Bone scintigraphy
- MRI
- Do not know

4) How soon after suspicion of diabetic osteoarthropathy does the patient obtain an appointment at your clinic?

|   | Within 1 day | 1-5 days | > 5 days | Do not know |
|---|-------------|---------|---------|-------------|
|   |             |         |         |             |

5) What treatment do patients with diabetic osteoarthropathy receive at your clinic?

- Total contact cast
- Bivalve cast (removable cast)
- Orthoses
- Do not know

6) If orthoses are used as a treatment, what type?

- AirCast Walker
- Don Joy Walker
- Other...

7) What is the treatment duration for patients with diabetic osteoarthropathy at your clinic?

|   | No treatment | <3 months | 3-6 months | 6-12 months | > 12 months |
|---|--------------|-----------|------------|-------------|------------|
|   |             |           |            |             |            |

8) Is there access to reconstructive foot surgery for foot deformities caused by diabetic osteoarthropathy?

- At our own clinic
- Regional hospital (specify ...)
- University hospital (specify ...)
- Do not know

Survey questions - Inventory of the management of patients with diabetic osteoarthropathy.

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