DANISH MEDICAL JOURNAL

Original Article

Use of compression therapy for cellulitis

Mia Nielsen & Mette Midttun

Department of Medicine, Copenhagen University Hospital – Herlev and Gentofte Hospital, Denmark

Dan Med J 2024;71(4):A08230530. doi: 10.61409/A08230530

ABSTRACT

INTRODUCTION. Cellulitis is a common infection, especially among the elderly, and compression therapy is often recommended to reduce acute oedema and pain. A previous study showed that compression therapy led to a lower incidence of recurrent cellulitis in lower extremities in patients with chronic oedema. The aim of this study was to describe clinical characteristics of patients with cellulitis.

METHODS. This was a retrospective descriptive study reviewing medical records and medicine registrations in patients ≥ 18 years with cellulitis.

RESULTS. A total of 104 patients were hospitalised with cellulitis; 13 were excluded. The median age was 75 years (range: 33-103 years), 64% > 70 years. The median admission time was five days (range: 1-24 days). Median antibiotic treatment duration was 11 days (range: 4-56 days). A total of 45% were current or former smokers, 40% were overweight, 48% had preexisting chronic oedema of the affected area, 90% had become infected in the lower extremities and 19% were readmitted within six months. A total of 51% had a new antibiotic treatment prescribed after being discharged, and 66% received compression therapy.

CONCLUSIONS. Cellulitis frequently affects older patients, especially smokers, people with overweight and chronic lymphoedema. In all, 66% were treated with compression therapy that did not have a clear effect on their readmission rate, probably because the patients receiving compression therapy had a more severe infection complicated by severe oedema and a higher risk of reinfection. An increased focus on the use of compression therapy in conjunction with health preventive interventions may have a positive impact on the relapse rate.

FUNDING. None.

TRIAL REGISTRATION. Not relevant.

Cellulitis is a common reason for hospital admission. Among predisposing risk factors for cellulitis are oedema in extremities, diabetes, immune suppression, obesity, smoking and frequent alcohol intake [1]. In addition to antibiotic treatment, elevation and compression treatment may be added as a supportive therapy to reduce acute oedema and pain [2, 3]. However, the extent compression to which therapy is used as a valid part of treatment guidelines seems to vary.

Oedema is part of the pathology of cellulitis [3-5]. Acute oedema is often initiated due to the inflammatory response in conjunction with involvement and damage of the lymphatic system [1]. The damage leads to obstruction of lymph vessels and thereby an increased level of interstitial protein, which provides better life conditions for bacteria [6]. The oedema frequently persists even though the infection has been defeated, and the immune response is therefore weakened [4, 5, 7]. If left untreated, oedema increases the risk of reinfection and morbidity [6].

It may be assumed that reduction of oedema by use of compression therapy improves the recovery of the lymphatic system and reduces the risk of infection and possibly even readmission. The use of compression bandaging in cellulitis builds on the hypothesis that reduction of the oedema, i.e. reduction of extracellular fluid, lowers the volume of the soft tissue thereby reduces the average distance of the infected tissue to the nearest capillaries and lymphatic vessels and thereby achieves a better supply of oxygen, antibiotics, and other contents of the blood to the infected tissues [5, 8]. A previous study showed that the use of compression bandage does not compromise microcirculation in the forefoot, and microcirculation remained unchanged during and after the use of compression [5].

The objective of this study was to describe the clinical characteristics of patients, the risk of relapse within six months and the use of compression therapy in patients with cellulitis admitted to one of two medical department in a Danish university hospital. Furthermore, we aimed to evaluate if patients treated with compression therapy had a lower relapse rate than other patients with cellulitis.

METHODS

We reviewed hospital medical records and antibiotic prescriptions for six months following discharge of patients admitted with cellulitis to a department of geriatrics or a department of infectious disease in a Danish university hospital. Patients with cellulitis were identified retrospectively from hospital diagnosis coding and were included from 1 June 2019 to 31 May 2020. We included cellulitis along with erysipelas with no distinction between the two diagnoses.

The inclusion criteria were 1) age ≥ 18 years and 2) cellulitis located at either upper or lower extremities to evaluate the potential use of compression therapy.

Baseline variables included: Demographics, such as sex and age. Comorbidities, confirmed by a diagnosis code or declared in the medical report by a physician, including chronic heart failure (CHF), COPD and chronic kidney disease (CKD). Risk factors of cellulitis in general, i.e. insulin-dependent or non-insulin-dependent diabetes, immune deficiency, alcohol overuse defined as > 7/14 items per week for female/male, respectively, smoking previously and/or currently, overweight defined as BMI ≥ 30 and/or overweight noted by the clinician. Chronic oedema (persistent oedema in the extremity reported by the patient or mentioned in the medical record), and if the patient was known with previous cellulitis in the affected extremity, either patient-reported or registered in the medical record.

Clinical variables included the localisation of cellulitis, the presence of acute oedema, days of hospitalisation and days of antibiotic treatment. The use of compression bandage was considered confirmed if registered in the medical record. Unfortunately, the duration of compression therapy and whether the compression treatment was initiated at admission or during admission were rarely documented.

Relapse was defined as readmission within six months for cellulitis in the same extremity and/or further antibiotics prescribed by general practitioners within six months after discharge. Mortality within six months was registered. Categorical variables were presented as number and percentage. Categorical variables were compared using the two-tailed Fischer's exact test. Continuous variables were presented as median and range.

Trial registration: not relevant.

RESULTS

A total of 91 patients were admitted with cellulitis. **Table 1** presents their baseline and clinical data. Median age

was 75 years (range: 33-103 years). Median time of admission was five days (range: 1-24 days). Of mention; diabetes, smoking and overweight were highly represented with 21%, 45% and 41%, respectively. Almost half of the patients (48%) had chronic oedema in the affected extremity, and 47% had had previous cellulitis in the same area. Patients were treated with antibiotics for a median 11 days (range: 4-56 days).

TABLE 1 Clinical characteristics and clinical variables (N = 91).

Clinical characteristics	
Age, median (range), yrs	75 (33-103)
Gender: female, n (%)	42 (46.2)
Recurrent cellulitis, n (%)	43 (47.3)[a]
Localisation: leg, n (%)	80 (87.9)
Diabetes, n (%):	
Insulin-dependent	4 (4.4)
No insulin	15 (16.5)
Subtotal	19 (20.9)
Chronic heart failure, n (%)	24 (26.4)
COPD, n (%)	9 (9.9)
Chronic kidney disease, n (%)	10 (11.0)
Immune suppression, n (%)	7 (7.7)
Chronic oedema, n (%)	44 (48.4)[b]
Alcohol > 7/14 items, past and current, n (%)	12 (13.2)
Smoking, past and current, n (%)	41 (45.1)
Overweight, n (%)	37 (40.7)
Acute oedema at affected area, n (%)	75 (82.4)[a]
Clinical variables	
Time of admission, median (range), days	5 (1-24)
Time with antibiotics, median (range), days	11 (4-56)
Compression therapy, n (%)	60 (65.9)
Readmission to hospital next 6 mos., n (%)	17 (18.7)
Antibiotics prescribed next 6 mos., n (%):	
Indication cellulitis	32[b, c]
Subtotal	46 (50.5)

a) 10 unknown.
b) 1 unknown.
c) Out of 46 patients.

Chronic oedema was significantly more likely in patients with recurrent cellulitis 67.4% versus 25% (p = 0.0001).

A total of 60 patients (66%) received compression therapy, which was most frequently prescribed (in hospital) to patients with recurrent cellulitis (55.0% versus 32.3%, p = 0.048) and patients with acute oedema (90.0% versus 67.7%, p = 0.018).

There was no significant difference in the use of compression therapy among patients known with chronic oedema as compared to others or on any of the other baseline and clinical variables.

A total of 17 patients (19%) were readmitted with cellulitis within six months. However, recurrence of cellulitis was even higher since 46 (51%) had antibiotics prescribed for cellulitis by their family doctor following discharge (Table 1). Unfortunately, it was not always possible to identify the indication for the prescription of antibiotics, but at least 36 patients were re-prescribed antibiotics for cellulitis within six months of discharge of whom 16 patients were readmitted (**Table 2**).

TABLE 2 Risk factors for readmission (N = 89[a]).

	Readmitted to hospital within 6 mos. (N_r = 17)	Not readmitted to hospital (N_n = 72)	p value
Age, median (range), yrs	74 (33-90)	74 (33-103)	-
Gender: female, n (%)	7 (41.2)	33 (45.8)	0.792
Recurrent cellulitis, n (%)	14 (82.4)[b]	29 (40.3)[c]	0.003
Time of admission, median (range), days	5 (2-22)	5 (1-24)	-
Time with antibiotics, median (range), days	13 (6-56)	10 (4-38)	-
Localisation: leg, n (%)	17 (100)	62 (86.1)	0.198
Diabetes, n (%)			
Insulin-dependent	1 (5.9)	2 (2.8)	0.475
No insulin	3 (17.6)	12 (16.7)	1.0
Subtotal	4	14	0.741
Chronic heart failure, n (%)	7 (41.2)	16 (22.2)	0.129
COPD, n (%)	1 (5.9)	8 (11.1)	1.0
Chronic kidney disease, n (%)	1 (5.9)	8 (11.1)	1.0
Immune suppression, n (%)	2 (11.8)	4 (5.6)	0.322
Chronic oedema, n (%)	13 (76.5)	31 (43.1)	0.016
Alcohol > 7/14 items, past and current, n (%)	4 (23.5)	8 (11.1)	0.233
Smoking, past and current, n (%)	7 (41.2)	33 (45.8)	0.792
Overweight, n (%)	6 (35.5)	30 (41.7)	0.785
Acute oedema at affected area, n (%)	17 (100)	56 (77.8)[b]	0.035
Compression therapy, n (%)	14 (82.4)	44 (61.1)	0.156
Antibiotics prescribed next 6 mos., n (%)			
Indication cellulitis	12[d]	20[d]	-
Subtotal	12 (70.6)	34 (47.2)	0.108

a) Due to 2 deaths during initial admission.
b) 1 unknown.
c) 7 unknown.
d) Out of those patients receiving antibiotics from their GP.

Patients with readmission were more likely to have recurrent cellulitis and chronic oedema than patients who were not readmitted (Table 2).

Chronic oedema was a major risk factor for readmission; 13 patients with chronic oedema (28.3%) versus four patients without chronic oedema (9.1%) (p = 0.03).

More patients being treated with compression 14 (23.3%) were readmitted than patients not receiving compression therapy (9.7%) (p = 0.158).

DISCUSSION

In the present study, median age was 75 years, which is high compared to other studies (range: 50-64 years) [2, 9]. This is most likely due to inclusion of patients from a department of geriatrics and a department of infectious medicine. Men were slightly overrepresented with 54%, which is in line with other studies [2, 9, 10].

Very few comparable publications exist, but the prevalence of CHF, COPD, diabetes and immune suppression are more or less mirrored in these studies [10-12]. The prevalence of alcohol overconsumption and overweight was in line with one and two studies, respectively [11-13]. Documenting former and current smoking as a single variable may explain why we found a much higher prevalence than other studies [11, 13].

Almost half of the study population had chronic oedema, and in this subgroup more patients were re-hospitalised, as was also the case in an English and a Norwegian study [7, 12]. In addition, more patients with chronic oedema had recurrent cellulitis, CHF, COPD and a high mortality rate, and more were treated with compression therapy. Our findings may support publications rating chronic oedema as one of the most frequent risk factors increasing morbidity [1, 4, 6]. Previous cellulitis was found in almost half of our study population, whereas other studies with larger study populations have reported around one third with previous cellulitis [9, 12]. Note that our study may be affected by information bias because several patients had an unknown previous cellulitis status. Nevertheless, recurrent cellulitis may still be established as an important cellulitis risk factor.

The high prevalence of chronic oedema and recurrent cellulitis may support the hypothesis mentioned previously about impairment of the lymph vessels. It may be assumed that chronic oedema and recurrent cellulitis establish a vicious circle [10], and that efforts to reduce oedema and re-infection may be crucial. Studies also mention that compression therapy is of considerable importance for this exact purpose [2, 5, 8].

The median length of hospitalisation was five days (range: 1-24 days) exactly like in two Swedish studies, though they had a wider range of 1-34 days [9, 10]. In countries outside Scandinavia, duration of stay was longer (e.g. 11-13 days) [9, 14]. The difference between international healthcare systems, different primary care provision practices or local differences in antibiotic administration may explain this variation of admission length.

The median 11-day duration of antibiotic treatment is identical to the duration reported in the study by Bläckberg et al. [9]. The very wide range from 4 to 56 days is noticeable and reflects one patient with an atypical and prolonged hospitalisation. Antibiotic treatment duration (five days) is shared by regional Danish guidelines, the English (NICE) guidelines, an English meta-analysis and recommendations from the American College of Physicians [15, 16]. However, the guidelines note that extension of antibiotic therapy up to 14 days may be needed based on severe infection or slow response to therapy. In general, a prolonged duration of antibiotics may reflect overconsumption, an overrepresentation of the sickest subpopulation or/and a severe infection. The considerable representation of patients with oedema in our study may explain the slow response to therapy and the need for longer treatment.

In the present study, the occurrence of readmission was 19% within six months. In other literature, this share was estimated to 29-47% with follow-up being conducted up to three years after the infection [7, 10]. The short follow-up period of the present study may explain the lower readmission rate. We found that especially patients with previous cellulitis, chronic oedema and patients presenting with acute oedema at their primary

hospitalisation were readmitted. Overall, these characteristics seem to describe patients with a compromised vascular and lymphatic system.

Two thirds of our patients received compression therapy. Some of the reasons why some patients did not receive bandages were: 1) Patient declined. 2) The prescription of compression may not be noted in the medical record even though it was effectuated. 3) The clinician forgot, did not know to or did not want to prescribe this additional treatment. It has previously been suggested that compression may induce pain, discomfort and soft tissue/nerve injury [14] and spread of infection [17] and that it may affect vascular perfusion [18]. The two latter assertions were subsequently denied if the external compression pressure does not exceed the perfusion pressure [3, 5, 8, 19]. The guidelines of the Danish Health Authority on treating chronic oedema in lower extremities also consider treatment with compression bandages appropriate.

Noticeable, though it was just a trend, more than half of patients with alcohol overconsumption were not treated with compression bandages, which may indicate a need to devote further attention to this group.

Seemingly, compression therapy did not affect the relapse rate even though results tended towards showing that the compression group had a higher readmission and repeated antibiotics rate than the non-compression group, but also, surprisingly, a lower mortality rate. Obviously, the sample size may contribute to this conflicting result. The results may reflect that the compression group had a more severe degree of oedema, which may be supported by a tendency towards a high frequency of some comorbidities in the compression group (CHF, CKD, immunosuppressants and chronic oedema), indicating a severe course of disease in this group.

CONCLUSIONS

Increasing age, smoking, overweight, recurrent cellulitis and chronic oedema were strongly represented in patients with cellulitis. Acute and chronic oedema in conjunction with recurrent cellulitis may increase the risk of readmission. Two thirds of all patients were treated with compression therapy, which did not have a clear positive or negative effect on the readmission rate. The reason for this was probably that patients treated with compression therapy had more severe infection, which was complicated by severe oedema, leading to higher risk and incidence of reinfection.

Several studies have shown that reduction of oedemas is crucial and that using compression treatment is possible and safe but, above all, it is important to treat or at least try to reduce the influence of triggering factors in parallel with the use of compression bandages.

Correspondence *Mette Midttun*. E-mail: memid@regionsjaelland.dk

Accepted 10 January 2024

Conflicts of interest none. Disclosure forms provided by the authors are available with the article at ugeskriftet.dk/dmj

Cite this as Dan Med J 2024;71(4):A08230530

doi 10.61409/A08230530

REFERENCES

1. Damstra RJ, van Steensel MAM, Boomsma JHB et al. Erysipelas as a sign of subclinical primary lymphoedema: a prospective quantitative scintigraphic study of 40 patients with unilateral erysipelas of the leg. Br J Dermatol. 2008;158(6):1210-5. doi:

https://doi.org/10.1111/j.1365-2133.2008.08503.x

2. Webb E, Neeman T, Bowden FJ et al. Compression therapy to prevent recurrent cellulitis of the leg. N Engl J Med. 2020;383:630-9. doi: https://doi.org/10.1056/NEJMoa1917197
3. Rabe E, Partsch H, Morrison N et al. Risks and contraindications of medical compression treatment - a critical reappraisal. An international consensus statement. Phlebology. 2020;35(7):447-60. doi: https://doi.org/10.1177/0268355520909066
4. Villefrance M, Høgh A, Kristensen LH. Compression is important in erysipelas treatment. Ugeskr Læger. 2017;179:V04170284.
5. Bojesen S, Midttun M, Wiese L. Compression bandaging does not compromise peripheral microcirculation in patients with cellulitis of the lower leg. Eur J Dermatol. 2019;29(4):396-400. doi: https://doi.org/10.1684/ejd.2019.3606
6. Vaillant L, Gironet N. Infectious complications of lymphedema. Rev Med Interne. 2002;23(suppl 3):403s-407s. doi: https://doi.org/10.1016/S0248-8663(02)80383-6
7. Cox NH. Oedema as a risk factor for multiple episodes of cellulitis/erysipelas of the lower leg: a series with community follow-up. Br J Dermatol. 2006;155(5):947-50. doi: https://doi.org/10.1111/j.1365-2133.2006.07419.x
8. Midttun M, Ahmadzay NF, Henriksen JH. Does comprilan bandage have any influence on peripheral perfusion in patients with oedema? Clin Physiol Funct Imaging. 2010;30(5):323-7. doi: https://doi.org/10.1111/j.1475-097X.2010.00945.x
9. Bläckberg A, Trell K, Rasmussen M. Erysipelas, a large retrospective study of aetiology and clinical presentation. BMC Infect Dis. 2015;15:402. doi: https://doi.org/10.1186/s12879-015-1134-2
10. Inghammar M, Rasmussen M, Linder A. Recurrent erysipelas - risk factors and clinical presentation. BMC Infect Dis. 2014;14:270. doi: https://doi.org/10.1186/1471-2334-14-270
11. Brishkoska-Boshkovski V, Kondova-Topuzovska I, Damevska K et al. Comorbidities as risk factors for acute and recurrent erysipelas. Open Access Maced J Med Sci. 2019;7(6):937-42. doi: https://doi.org/10.3889/oamjms.2019.214
12. Bruun T, Oppegaard O, Kittang BR et al. Etiology of cellulitis and clinical prediction of streptococcal disease: a prospective study. Open Forum Infect Dis. 2015;3(1):ofv181. doi: https://doi.org/10.1093/ofid/ofv181
13. Garg A, Lavian J, Lin G et al. Clinical characteristics associated with days to discharge among patients admitted with a primary diagnosis of lower limb cellulitis. J Am Acad Dermatol. 2017;76(4):626-31. doi: https://doi.org/10.1016/j.jaad.2016.11.063
14. Roda Â, Pinto AM, Filipe AR et al. Clinical and laboratory factors associated with prolonged hospital stay among patients with cellulitis/erysipelas. Acta Med Port. 2019;32(6):448-52. doi: https://doi.org/10.20344/amp.10735
15. Cross ELA, Jordan H, Godfrey R et al. Route and duration of antibiotic therapy in acute cellulitis: a systematic review and meta-analysis of the effectiveness and harms of antibiotic treatment. J Infect. 2020;81(4):521-31. doi: https://doi.org/10.1016/j.jinf.2020.07.030
16. Lee RA, Centor RM, Humphrey LL et al. Appropriate use of short-course antibiotics in common infections: best practice advice from the American College of Physicians. Ann Intern Med. 2021;174(6):822-7. doi: https://doi.org/10.7326/M20-7355
17. Hansson C, Faergemann J, Swanbeck G. Fungal infections occurring under bandages in leg ulcer patients. Acta Derm Venereol. 1987;67(4):341-5. Doi: https://doi.org/10.2340/0001555567341345
18. O'Meara S, Cullum NA, Nelson EA. Compression for venous leg ulcers. Cochrane Database Syst Rev. 2009;(1):CD000265. doi: 10.1002/14651858.CD000265.pub2. Update in: Cochrane Database Syst Rev. 2012;11(11):CD000265. doi: https://doi.org/10.1002/14651858.CD000265.pub3
19. Eder S, Stücker M, Läuchli S et al. Is compression therapy contraindicated for lower leg erysipelas?: Results of a retrospective analysis. Hautarzt. 2021;72(1):34-41. doi: https://doi.org/10.1007/s00105-020-04682-4

