



ROLE OF COMPRESSION THERAPY IN THE MANAGEMENT OF CELLULITIS: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

Surgery

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ABSTRACT

In the surgical ward Cellulitis remains most prevalent condition causing significant morbidity. Management of cellulitis includes the use of antibiotics, limb elevation and analgesics. There is no consensus protocol or review on the role of compression therapy in the management of cellulitis. This Prospective randomized controlled Study was a comparative study of patients who presented with cellulitis at the department of surgery in a teaching hospital. The study was intendant to assess the effect of compression therapy as an adjunct in the treatment of limb lower limb cellulitis. The study was carried out between April 2017 and March 2018. Patients admitted in the surgical wards were randomly assigned into two groups through a sequential generated program. Group A patients were managed with broad spectrum antibiotics, limb elevation, analgesia and elastic compression therapy using elastic compression bandage. The other Group B patients were managed with elevation, broad spectrum antibiotics and analgesia only and no compression bandages applied. The antibiotic used was third generation cephalosporine while the analgesic was paracetamol and diclofenac. Edema resolution, pain, tenderness and length of hospital stay parameters were assessed for all patients in both the groups. A total of 100 patients with cellulitis were included in to two groups with each arm having 50 patients. Group A patients who were managed with compression therapy had greater reduction in pain, tenderness and oedema as compared to group B patients which was statically significant. The length of mean hospital stay was 10.2 days in group A and mean hospital stay was 13.4 days in group B. Elastic compression therapy as demonstrated in this study is beneficial in the management of cellulitis. It enhances and promote faster resolution of cellulitis resulting in the reduction in the length of hospital stay ,early recovery and with no increase in complications.

KEYWORDS

Cellulitis, Compression Therapy, Outcome

1. INTRODUCTION

Cellulitis in adults is a common surgical condition taking up a large number of occupied bed days in hospitals. Cellulitis is defined as the infection of the subcutaneous tissues and the dermis (1). When not appropriately managed it can result in morbidities including necrotizing fasciitis and progress as pyemia, septicemia, SIRS and MODES. The cellulitis can also impede the blood vessels and cause gangrene if not treated adequately.

When there is a rapidly progressive and destructive soft tissue infection involving the subcutaneous tissue and fascia, it is termed as Necrotizing fasciitis (NF). Initially, Skin may be spared and presenting signs are often non-specific and may resemble cellulitis. Though NF is rare it often ends up with high mortality of approximately 50 %.⁽²⁾

The most commonly associated infective organisms in adults are streptococci (esp. *Strep. pyogenes*) and *Staph. aureus* (1). *Strep. pneumoniae*, *Haemophilus influenzae*, Gram-negative bacilli and anaerobes are less common organisms 7. There are not much Research data on the risk factors for developing cellulitis. However, in a case-control study in 1999 Ramirez et al have found that a potential site of entry (eg. leg ulcer, toe web intertrigo, traumatic wound), lymphoedema, leg oedema, venous insufficiency and being overweight were all factors that may predispose to cellulitis⁽³⁾

In spite of being a relatively common problem, there is a relative lack of good evidence-based literature for the management of patients with cellulitis. Reported protocols trials and trials of treatment options are often small and inconclusive. As a result of this most often the clinical practices are variable and often inconsistent.

Cellulitis generally presents as the acute and progressive onset of a red, painful, hot, tender and, swollen area of skin which yields to pressure. The edge of the erythema will be usually well demarcated or more diffuse and typically spreads rapidly. Constitutional symptoms fever and malaise occur in the majority of the cases, and it can present much before the localizing signs. Blistering/bullae, superficial hemorrhage into blisters, dermal necrosis, and lymphadenopathy may occur. Differential diagnosis includes lower leg eczema, oedema, blisters, acute phlebitis, deep venous thrombosis (DVT), thrombophlebitis, and vasculitis⁽⁴⁾.

The mainstay of management has been by the use of antibiotics, limb elevation and analgesics. Compression therapy either dynamic or

static has not been routinely used in the management of cellulitis, though its role in the treatment of lymphoedema and the venous ulcer is well established⁽⁵⁾. Compression will improve tissue perfusion at the cellular level by reducing the interstitial fluids and thereby enabling better oxygen and nutrients delivery to the cells resulting in rapid healing of the wounds⁽⁶⁾. There are many studies to establish the role of Compression therapy resulting in faster healing of venous ulcers and reduction of oedema.⁽⁷⁾ However, its role in the treatment of cellulitis is still debatable.⁽⁸⁾

In this prospective controlled randomized study, we aimed to establish if compression therapy could be beneficial and could enhance the resolution of cellulitis in the management of patients with cellulitis and have established its effects.

2. MATERIALS AND METHODS

Objective:

To determine the role and effect of compression therapy as an adjuvant for the management of limb cellulitis.

STUDY DESIGN:

This prospective randomized controlled study was carried out in the Department of General surgery of Kanyakumari Government Medical College. All patients fitting into the diagnostic criteria were included in the study.

Duration of study: one year 2017 April to 2018 March

Randomization:

The study was done with 100 patients. Simple sequential randomization is used and all the patients were grouped into two groups.

1. Group A: Experimental group - 50 patients
2. Group B: Control group - 50 patients

Inclusion Criteria:

- Patient with a diagnosis of cellulitis
- Age 25-75 both sex
- Willing to participate and give informed consent.

Exclusion Criteria:

- Patient with the active comorbid condition
- Active ulcer or septicemia
- Immunocompromised individuals
- Patient not willing to give consent
- Pregnancy

- Malignancy
- Chronic alcoholic and smokers

Ethical consideration:

For this study ethical clearance was obtained from the college ethical board. Both written and oral information in the local language given to the participants of the study and their signature obtained.. Participants were given the liberty to withdraw from the study at any time

Data collection and analysis:

Demographic data of all patients obtained. Following Variables pain, tenderness, edema resolution, White blood cells count, length of hospital stay and complications were observed and data tabulated in computer excel sheet. Statistical analysis was done using SPSS 20 Package and significance of data are assessed by Chi-square analysis and the p-value less than 0.005 was considered as significant.

Procedure:

On admission in the study, patients had their blood was taken for white blood cell count, blood sugar, HB, ESR, BT, CT. The same was repeated after two days. Patient's pain assessment was done using the pain visual analogue scale score and tenderness by the tenderness evaluation study in the first four days. The pain was graded into mild, moderate or severe using this scale. Tenderness was graded as;

Grade 1; feels pain on palpation,

Grade2; feels pain and winces on palpation of the limb

Grade3; feels pain winces and withdraws limb on palpation,

Grade 4; doesn't allow palpation due to fear of severe pain.

The limb measurements were taken at a constant point from the nearby bony prominence. These measurements were repeated on the 3rd and 6th day. The extent of oedema was measured as the difference in girth between the affected limb and the normal limb.

All patients were started on intravenous 3rd generation cephalosporins at a recommended dose for weight. The analgesics given for the patients was a combination of paracetamol and diclofenac acid orally or injectable as per the pain score.

Group A patients had compression with an elastic pressure bandage, The bandage was applied over the soft pad dressings (figure 1, 2). Prior to the placements of the stockings, the limb girth measurements were taken as mentioned earlier. The compression garments were left on until the third day after which the limb girth measurement was taken again and on the 6th day.

In Group B patients no compression bandages were applied.



Figure 1: Soft pad applied on the limb with cellulitis



Figure 2: Elastic compression dressing applied over the limb with cellulitis.

3. RESULTS:

1. Demographic Data:

A total of 100 patients with cellulitis who made the inclusion criteria were recruited with 50 patients in each group. The male to female ratio for group A patients was 3:2 while in group B was 3.2:1.8. The majority of patients were from the age group of 40-60. The mean age for the patients in group A was 42.8 and 44.5 years in group B.

There was no significance differences in the causation of cellulitis between two groups In majority of the patients trauma was reported as the initiator of cellulitis.(Group A, 62.5 and group B 67.5 percent). Diabetes mellitus accounted as a predisposing factor for 18 percent of patients in group A and 22 percent in group B.

Variable	Intervention group		Total	Chi-square	P value
Gender	A	B	100		
Male	30	32	62	5.76	0.0164
Female	20	18	38		
Age group	15	14	29	11.78	0.0028
25-40	24	25	49		
40 -60	10	12	22		
• 60					
Causation of cellulitis	31	33	64	26.32	0.0001
1, Trauma	10	12	22		
2, Diabetes	9	5	14		
3. Others					

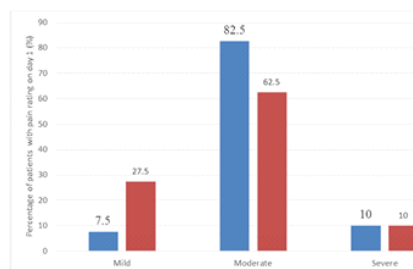
2. Pain factor:

On admission most of the patients in both the groups had moderate to severe pains and the data is shown in Figure3. There was more reduction in pain severity in patients in group A both on the 2nd and 4th day of assessment as compared to the patients in group B and shown in table1.

Table 1. Pain assessment on day 2 and day 4.

	Variable	Group A	Group B	Chi-square	P value
1.	Pain assessment on day 2				
	• 50 % change	41(82)	23(57.5)	6	0.015
	< 50 % change	9(18)	17(42.5)		
2	Pain assessment on day 4				
	• 50% change	46(92)	33(66)	9	0.003
	< 50 % change	3(7.5)	22(44)		

Figure 3: Baseline pain presentation on day 1



3. Edema:

45percent of the patients in group A had edema reduction of more than 50 percent on day 3 and 95 percent on day 6 as compared to 27.5 percent and 85 percent respectively among group B patients. (Table: 2). The reduction in the odema on day 3rd and 6th are significant with p value less than .005.

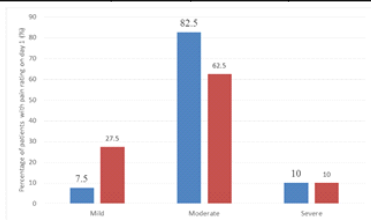
Table 2: Edema assessment on day 2 and day 6,

	Variable	Group A	Group B	Chi-square	P value
1.	odema assessment on day 3				
	• 50 % change	14(44)	14(28)	2	0.016
	< 50 % change	28(56)	36(72)		
2	odema assessment on day 6				
	• 50% change	47(94)	42(84)	2,2	0.0136
	< 50 % change	3(06)	8(16)		

3. Tenderness: On admission most of the patients in both the groups had moderate to severe tenderness and the data is shown in Figure4. There was significant reduction in tenderness in patients in group A as compared to group B on day 2 and 4. (Table 3)

Table: 3. Evaluation of tenderness score in patients on days 2 and 4

Variable	Group A	Group B	Chi-square	P value
1. Assessment of tenderness on day 2				
• 50 % Reduced	48(96)	38(76)	6.3	0.012
< 50 % Reduced	02(04)	12(24)		
2. Assessment of tenderness on day 4				
• 50% Reduced	49(98)	41(82)	5	0.025
< 50 % Reduced	1(02)	9(18)		

**Figure: 4.** Tenderness in patients in group A (blue) and group B (red) at the time of admission.**Table 4: Treatment outcome variables.**

N	Variables	Group A	Group B	Chi-square t-value*	P value	significance
1	Reduction in white blood cell count on admission and on 6th day	13456/ccm 13134/ccm	13513/ccm 13238/ccm	0.0447	.832639	Not Significant
2	Length of hospital stay	10.6	13.2	*24.2487	.00001	Significant
3	Development of superficial ulceration	5	4	*1.1274	.1513	Not Significant
4	Development of subcutaneous abscess	3	4	*1.224	.1332	Not Significant
5	Patient satisfaction on the outcome.	92%	82%	*8.270	.00008	Significant

4. DISCUSSION

Cellulitis is a common acute, spreading pyogenic inflammation of the skin and subcutaneous tissue, usually complicating a wound, ulcer or dermatosis ⁽⁹⁾. Earlier erysipelas, was considered as a separate disease entity with a well-defined raised edge and more prominent systemic symptoms involving the only dermis, but now considered as a manifestation of cellulitis, by virtue of its ability to extend to the dermal layers, and practically it is impossible to make a meaningful distinction. ⁽¹⁰⁾

The infections are associated with intensive inflammation and it manifests with marked swelling due to oedema, pain and tenderness. Resulting oedema impairs the tissue perfusion; thereby effects decreased delivery of oxygen, nutrients and antibiotics. Though edema prolongs cellulitis and results in a bad outcome, most often the treatment interventions have only focused on the usage of antibiotics and pain management with the minimal focus on the management of oedema other than limb elevation. ⁽¹¹⁾

Compression therapy is an option for the management of oedema and has been discouraged citing the theoretical risk of bacterial translocation to the bloodstream. It has also been thought that applying compression stockings in the acute setting will be painful to the patient and should therefore only be applied once the acute phase of the illness is over ⁽¹²⁾. The observations in our study contradict the above-held notions and have shown the statically significant positive impact on the outcome of the management.

Patients who were managed on compression bandage resulted in faster relief from pain. Their tenderness scores improved much. Reduction in the pain score and tenderness scores were also noted in compression therapy when applied for conditions such as venous ulcers and lymphedema. ^(13,14)

Compression therapy increases shear stress in the microcirculation, as the result of which there will be the release of the anti-inflammatory cytokines and antithrombotic from the endothelial cells ⁽¹⁵⁾. The most common anti-inflammatory cytokines elevated in patients with compression therapy will be IL-1Ra. Pro-inflammatory cytokines and Metalloproteinase were also been shown to be decreased in patients with compression therapy. Compression enhances the inflammatory response by down-regulation of the proinflammatory cytokines and up-regulating the anti-inflammatory cytokines resulting in less pain, tenderness and oedema. ⁽¹⁶⁾

In cellulitis, oedema is the predisposing factor for the infection and it has a deleterious effect on the healing. Compression therapy plays a

All patients had elevated white blood cells count at the time of admission. The white cell counts values were also measured on the day 6th. There was no statistical difference in both groups for the number of patients whose white blood cell counts returned to normal levels both on day 3 and 6.

The duration of hospital stay in group A patients was 10. 6 days while in group B patients 13. 2 days. This was statistically significant.

5 patients in group A had superficial ulcerations compared to 4 patients in group B during the period of management. This was not statistically significant.

3 patients in group A and 4Group B formed abscesses that were drained. This was not statistically significant.

On discharge the patient satisfaction was tested with the standard questionnaire and for the Group A we had overall satisfaction of 92% and for the group B the overall satisfaction was only 82% and this is a statistically significant observation.

vital role in the reduction of the time taken for reducing this oedema and as a result of which in patients having compression therapy have the lesser hospital stay in comparison with people not getting compression therapy.

When as the result of cellulitis oedema sets in, it will impair the tissue perfusion and thereby reduces delivery of nutrients, oxygen and antibiotics. The normal innate antimicrobial property of the skin will be also affected by oedema and it will predispose infection. In lymphedema, as there is the accumulation of macromolecular protein with high protein concentration, it will encourage, bacterial proliferation and growth. ⁽¹⁷⁾. Elevation of the limb tends to assist in the reduction of oedema by the passive process of fluid shifts as per the differences in the hydrostatic and oncotic pressure. Compression therapy by virtue of its effects increase, the interstitial pressure, reduces the exudates from the capillaries and stimulates venous return.

CONCLUSION:

Based on our study we conclude adding the compressive bandage therapy in the treatment of cellulitis will enhance early resolution of edema, tenderness and pain and thereby early healing without any additional complications.

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