

# Role of Adjuvant Topical Oxygen Therapy (Topox) Versus Conventional Methods in The Management of Non-Healing Infected Wounds

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## ABSTRACT

**Objectives:** To compare the role of adjuvant topical oxygen therapy versus conventional methods in the management of non-healing infected wounds. **Study Design:** Simple comparative study. **Setting:** The study was carried out in one year duration from January 2010 to December 2010 in Surgical unit-1 Allied Hospital Faisalabad. **Sample Size:** 60 patients. **Methods:** Total of 60 patients was divided into two groups. In one group (A) topical oxygen therapy was given along with conventional measures for management of wound. In second group (B) only conventional methods were used for wounds. **Results:** 60 cases included in this study, 30 in group A and 30 in group B. From patients of group A, 16(53.3%) showed clinical improvement in first week and 25(83.3%) showed clinical improvement in second week. While in group B 5(17%) and 11(36.7%) showed clinical improvement in first and

second week respectively. 5(17%) patients in group A developed granulation tissue in first week and 19(63%) in second week. While in group B 2 (7%) developed granulation tissue in first week and 8(27%) in second week. From group A 10(33.3%) and 24(80%) patients showed complete wound healing in second and third months respectively. In group B 3(10%) patients showed complete wound healing in two months and 12(40%) in three months. 1(3.3%) patient in group A deteriorated in first week and 2(7%) in second week. 8(27%) patients from group B deteriorated in first week and 4(13.3%) in second week. **Conclusion:** Use of TOPOX along with conventional method is more safe and effective in the management of non-healing infected wound than conventional methods alone **Key Words:** Infected wounds, treatment, topical Oxygen therapy.

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## INTRODUCTION

Infection is defined as the presence of replicating microorganisms in a wound, leading to subsequent host injury. Wound Infection is considered as a major factor in delayed wound healing, reduced tissue tensile strength gain, formation of exuberant granulation tissue and dehiscence following wound closure.<sup>1</sup> Wound management techniques are continuously developing.

Non healing infected wound are usually managed by following conventional measures.

- Debridement
- Wound wash
- Repeated dressings

In Debridement of non healing chronic wounds all devitalized tissue is removed. It removes potentially infected tissue. Healthy bleeding tissue introduces

beneficial platelets and Growth factors. But usually multiple debridements are needed and it increases size of wound and delays closure of wounds. It also increases morbidity<sup>4</sup>. Next method is repeated wound wash. Wound wash is done with normal saline, hydrogen peroxide and Pyodine solution. This is economical and easily available method. But Pyodine solution if used repeatedly decreases collagen synthesis. Also Pyodine is not sterile, in fact some bacteria and fungi thrive in it.<sup>5</sup> Hydrogen peroxide is also used to kill the micro-organisms but dangerous if used in deep wounds or tunnels due to risk of pressure and embolism.<sup>6</sup> Repeated dressings with different forms of gels and chemicals is another way of management of infected non-healing wound. They work by mechanism of chemical debridement. These

are usually very costly, have poor patient compliance and not very effective. Topox is a technique of delivering 100% oxygen directly to an open, moist wounds at a pressure higher than atmospheric pressure. It is hypothesized that the high concentration of oxygen diffuses directly into the wound to increase the local cellular oxygen tension, which in turn promotes wound healing. Topox acts in the following ways.<sup>7</sup>

Promotes angiogenesis, fibroblast activation and wound healing.

- Kills certain anaerobes.
- Prevents growth of species such as Pseudomonas.
- Prevents production of clostridial alpha toxin.
- Causes up regulation of growth factors, down regulation of inflammatory cytokines.
- Restores neutrophil mediated bacterial killing in previously hypoxic tissues.

Topical hyperbaric oxygen devices consist of an appliance to enclose the wound area and a source of oxygen; conventional oxygen tanks may be used. The appliances may be disposable and may be used without supervision in the home by well-trained patients. Topox has been investigated as a treatment of skin ulcerations due to diabetes, venous stasis, post surgical infection, gangrenous lesion, decubitus ulcers, amputations, skin graft, burns, or frostbite<sup>8</sup>. Studies carried out previously showed that Topox offers best outcome in the management of wound. Topox when used with conventional methods is cost effective and promotes wound healing earlier than conventional methods.

### OBJECTIVES

The objective of our study is to compare the role of adjuvant topical oxygen therapy versus conventional methods in the management of non-healing infected wounds.

### HYPOTHESIS

Topical oxygen therapy when used with conventional methods is more superior to conventional methods alone in the management of non-healing infected wounds.

### MATERIAL & METHODS

#### Study design

Simple comparative study

### Setting

60 bedded surgical unit I of Allied Hospital Faisalabad, tertiary care unit 1500 bedded hospital.

### Duration of study

One year starting from January 2010 to December 2010.

### Sample size

Calculated by using WHO software recommended by C.P.S.P. By applying the following formula, (S.S = 60 Pts).

### Sample size for comparing two means

Continence Index (2 sided) 95%  
Power 80%  
Ratio of sample size(Group A/Group B) 1

	Group A	Group B	Mean
Mean	57.8	39.9	Difference
Standard Deviation	29.2	18.8	17.9
Variance	852.64	353.44	
Total patient (Divided in Two Groups)			60

### Group A

Topical oxygen therapy was given along with conventional measures.

### Group B

Only conventional methods of wound care were applied.

### Sample technique

Simple random sampling.

### Sample selection

1. All the patients between 13 to 60 years of age of either gender having infected wounds

### Exclusion criteria

1. Patient with healthy looking wound.
2. Patients below the age of 13 & above 60 years of age.
3. Advanced malignancy with metastasis.
4. Patients who refused to participate.

### OPERATIONAL DEFINITIONS

#### Clinical improvement

It is decrease in discharge of pus, settlement of local and systemic manifestations of inflammation in the form of control on temperature, septicemia, cellulitis and edema of skin surrounding infected tissue

#### Complications

It is defined by progression of disease in the form of

ncrease in discharge of pus, septicemia, multi-organ failure and even death of patient.

**Complete wound healing**

It is defined as complete closure of wound either by delayed primary healing or secondary healing.

**OPERATIVE PROCEDURE**

All patients included in the study were admitted either through out patient department (OPD) or emergency ward. Regarding the ethical issues patients were explained the nature of procedure its benefits and drawbacks and an informed consent was obtained. All patients received a single dose of prophylactic intravenous antibiotic half hour before induction of anesthesia. Good debridement of wound done removing all dirty tissue. A simply available cellophane bag, sterilized with antiseptic solution, tailored according to the size of the affected part used, tapped on open side of body of patient like tourniquet. 100% oxygen was transferred in bag with routinely available oxygen cylinder. Exposing the whole affected part of body or limb. Oxygen in chambers was given maximum for one and half hours twice daily in one sitting, for 5 to 7 days. In the interval between cycles wound was covered with soaked antiseptic wound dressings. The Urine out put and daily oral in take of patient was monitored. Limb elevation was done in case of affected limb. Gram positive, gram negative and anaerobic cover given with Hospital available brands. Daily wound washed with normal saline.

**Figure-1**  
**Patient receiving topical oxygen therapy**



**Figure-2**  
**Wound after topical oxygen therapy**



**DATA ANALYSIS PROCEDURE**

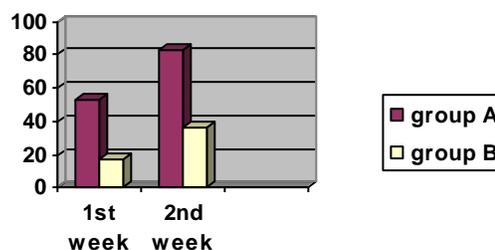
Data will be analyzed by software SPSS version 10.

**RESULTS**

In one year study two groups of patients were taken, all 60 patients were having grossly infected wound with frank drainage of pus from wound and dirty wound bed. One group was treated only with conventional methods and other treated with Topox along with conventional methods. These groups were similar with respect to age, gender distribution, HbA1c.

**Figure-3**  
**Clinical improvement**

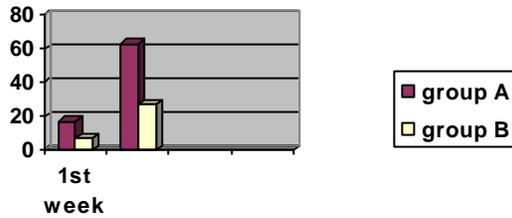
	First week	Second week
Group A	16(53.3%)	25(83.3%)
Group B	5 (17%)	1(36.7%)



From the patients of group A, 16(53.3%) patient showed clinical improvement in the first week and 25(83.3%) showed improvement in the second week. While in second group where conventional methods were used 5(17%) patient showed clinical improvement in first week and 11(36.7%) showed improvement in second week.

**Figure -4**  
**Granulation tissue formation**

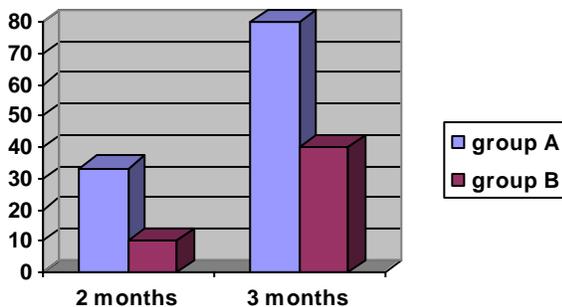
	First week	Second week
Group A	5(17%)	19(63%)
Group B	2 (7%)	8(27%)



5(17%) patients in group A developed granulation tissue in first week and 19(63%) developed granulation tissue in second week. While in group B, 2 (7%) patients developed granulation tissue in first week and 8 (27%) patients developed granulation tissue in second week.

**Figure-5**  
**Complete wound healing**

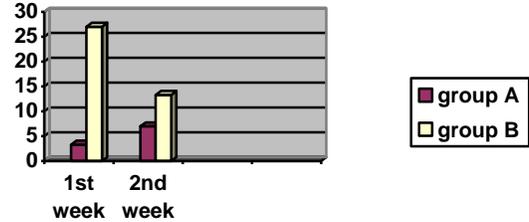
	2 months	3 months
Group A	10(33.3%)	24(80%)
Group B	3(10%)	12(40%)



Regarding complete healing of wound, 10(33.3%) patients in group A showed complete healing in two months while 24(80%) showed complete healing in three months. 3(10%) patients in group B showed complete wound healing in two months while 12(40%) patients showed complete healing in three months.

**Figure-6**  
**Complications**

	2 months	3 months
Group A	1(3.3%)	2(7%)
Group B	8 (27%)	4(13.3)



1(3.3%) patient in group A deteriorated clinically due to local and systemic effects of wound in first week and 2 (7%) patients deteriorated in second week of management. 8(27%) patients from group B deteriorated and underwent complications of wound in first week and 4(13.3%) deteriorated in second week of treatment.

## DISCUSSION

Our study results showed that wounds in patients treated with adjuvant Topox significantly improved and during a shorter period of time than wounds in patients receiving treatment with conventional methods. Topox is easy to apply and is cost effective. In this study patients having grossly infected non-healing wounds were taken. Concerned staff, patient attendants and patients were fully guided and counseled regarding methods of treatment to make our objective more effective. The patient managed with adjuvant Topox therapy improved rapidly in various aspects. Discharge of pus decreased from wounds earlier. Local and systemic manifestations of inflammation settled down earlier in the form of earlier control on temperature, septicemia, cellulitis and edema of infected tissue. Wounds also became healthy looking earlier in patients in whom topical oxygen therapy was used due to early formation of more granulation tissue. It was due to fact that oxygen delivered through topical oxygen therapy stimulated vasculogenesis and by combination of other beneficial effects it promoted granulation tissue

formation. Sizes of wounds were also smaller than the wound of patient managed by conventional methods. This was due to fact that the patients that were treated with conventional methods alone underwent extensive debridements again and again leading to increase in size of wound that later on will definitely add in the morbidity of patient due to long time taken for there closure. Patients of group A showed complete healing of wound earlier than the patients of group B. Also complication rate in the form of progression of disease or death of patients due to multi-organ dysfunction was very high in patients treated with conventional methods than those treated with topical oxygen therapy. This was due to fact that conventional methods alone offer less control of wound than adjuvant Topox and this ultimately leads to early development of multi-organ dysfunction in patients. A new study<sup>11</sup> suggests that brief exposures to pure oxygen not only help chronic and other hard-to-heal wounds heal completely; such exposures also help wounds to heal faster. Ohio State University surgical scientists used topical oxygen therapy to treat 30 patients with a total of 56 wounds. More than two-thirds of the difficult wounds healed with the oxygen treatment alone. 68% (38 out of 56) of the wounds healed with the oxygen treatment. In our study conducted in Allied hospital 80% patients healed with topical oxygen therapy earlier than conventional methods. Heng et al<sup>12</sup> conducted a study utilizing topical oxygen therapy. He concluded that the patient who received Topox therapy 90% of the wounds healed as compared to 22% in the control group. Tawfick et al<sup>13</sup> recently published the results of an 83-patient parallel observational study comparing Topox and conventional compression therapy used in venous ulcer management. After 12 weeks, 80% of Topox managed ulcers were completely healed (median 45 days) compared to 35% of the control group ulcers (median 182 days) (P <0.0001).

## CONCLUSION

Adjuvant topical oxygen therapy is safe and effective in the management of non-healing infected wound. It has a superior outcome to conventional methods of

wound management alone through achieving a shorter healing time, alleviating pain, and reducing recurrence rates. We believe that adjuvant topical oxygen therapy is a valuable tool in the management of patients with non-healing infected wounds.

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