

## Pattern of Wound Healing In Burn Patients Nursed On Air Fluidized Bed System: A Study of 37 Cases

Poonam Gupta<sup>1</sup>, Shammi Purwar<sup>2\*</sup>, Shesh Kumar<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Surgery, UPUMS, Saifai-Etawah, Uttar Pradesh, India

<sup>2</sup>Assistant Professor, Department of Plastic Surgery, UPUMS, Saifai-Etawah, Uttar Pradesh, India

<sup>3</sup>Assistant Professor, Department of Surgery, UPUMS, Saifai-Etawah, Uttar Pradesh, India

Received: 11-09-2021 / Revised: 25-10-2021 / Accepted: 17-11-2021

### Abstract

**Background:** Burn injuries are very common all over the world. Wound healing in major burns is a challenging task. Air fluidized therapy was introduced in 1960. It provides unique environment for healing of these burn wounds and is different from the support system provided by normal conventional beds. The air fluidized bed uses warm air under pressure to set small ceramic beads in motion which simulates the movement of fluid creating characteristic of fluid. This in turn evenly distributes the weight that creates a sensation of "floating". The fluid support reduces friction, shear, pressure and mechanical stress to the burnt areas and subcutaneous tissues. **Methods:** The study was conducted over a period of one year from December 19 to December 20 at department of plastic surgery, Uttar Pradesh University of Medical Sciences, Saifai-Etawah, INDIA. Patients with old infected burns, those with co-morbidities and with pre-existing illnesses were excluded from this study. Burns more deep than second degree are also excluded. Baseline data were also recorded at the time of admission. **Results:** The total number of patients included in this study were 37. The average age was 35 years. Females outnumbered males. Average length of hospital stay was 17 days. Four patients did not heal adequately and needed split skin grafting. Few patients required hospital stay of 20 days. **Conclusions:** The wound healing in burn patients nursed on air fluidized bed is faster than conventional setting. It also reduces psychological trauma like post traumatic stress disorder (PTSD) as well as overall mortality.

**Keywords:** Air fluidized bed, burns, air fluidized therapy, burn trauma, major burns

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Burn injuries are very common throughout the globe and also in our country. Air fluidized therapy was developed way back in 1960, it provides an effective treatment which reduces pressure, friction and shearing and also decreases moisture. Although air fluidized system is commonly used for patients with pressure ulcers and have reported improved results, we have used it on 17 patients for treatment of burns in last one year and our initial results are encouraging. The air fluidized system provides a very unique environment for healing of burn wounds that is different from the support provided by normal conventional beds. An air-fluidized bed uses warm air under pressure to set small ceramic beads in motion which simulate the movement of fluid; the circulation of filtered air through silicone coated ceramic beads creates the characteristics of fluid [1,2,3]. When the patient is placed in the bed, his body weight is evenly distributed over a large surface area which creates a sensation of "floating." The fluid support covers the body surface to its maximum and reduces friction, shear, pressure and mechanical stress to the burnt areas and to the subcutaneous tissues. The inbuilt temperature control system also helps in controlling the microclimate which is very much needed for the comfort of the patient and for treatment.

There are many clinical benefits of air fluidized therapy like faster healing, cost effective and less number of days in hospital leading to improved survival and less mortality.

Pressure reduction or redistribution is the key concept of air fluidized system. It redistributes the weight, improves circulation and thus promotes the process of healing. Pressure reduction can be achieved by special beds like air fluidized beds, low-air loss beds, powered and non-powered overlays or mattresses. Air fluidized therapy developed in 1960s reduces pressure, friction, shear forces and moisture thereby improves healing [2].

Since late 1960s, air fluidized therapy (AFT) has been efficiently used to treat patients with pressure ulcer, burns and many other clinical problems. Much of the clinical efficacy is thought to be due to unique fluid environment that redistributes weight and is quite different from the conventional beds. Fluid support has many benefits. It reduces shear, friction, pressure and mechanical stress. The variable temperature airflow also provides controlled microclimate for the optimum comfort of the patients.

AFT provides many clinical benefits which includes its cost-effectiveness, faster healing and reduced hospital stay. All this is also helpful in reducing mortality. It also reduces or eliminates the need for frequent change of position thereby relaxation in the responsibility of caregivers and nursing staff in case the patient is hospitalized. Warm air is used under pressure which sets small ceramic beads in motion which simulates the movement of fluid. The air circulates through the silicone coated ceramic beads that creates the characteristics of fluid. Thus when the patient is placed on such fluid like bed, the weight of the body of the patient is evenly distributed and this redistribution of weight creates a feeling of floating which finally helps in achieving goals of faster healing. The air fluidized bed (AFB) were inducted in our department in 2018. This system bears significant cost which can be acceptable should it provide definite clinical advantage. The parameters of each patient were taken in

\*Correspondence

**Dr. Shammi Purwar**

Assistant Professor, Department of Plastic Surgery, UPUMS, Saifai-Etawah, Uttar Pradesh, India

E-mail: [shammi\\_purwar@rediffmail.com](mailto:shammi_purwar@rediffmail.com)

account such as mortality, duration of hospital stay and percentage of total body surface area (TBSA) burn.

In the process of hospitalization, the warm air is blown through small ceramic beads creating a fluid like environment without actually wetting. The warmth has many advantages including reduction of metabolic rate in burns. Decreased metabolic rate has advantageous effect on reducing mortality, modifying catabolism and stability of temperature. It also reduces the need of frequent posture change thus reducing the work of nursing staff and caregivers[3].The process of making solid particles ( a fixed bed) adopt the properties of a fluid without wetness is known as fluidization[7].The bed consists of a tank which is filled with silicone coated beads and the warm air bubbles erupt through these beads. This process is known as slugging. It results in bubbles coming through these beads as if it is boiling. The air temperature and humidity is adjustable according to the comfort of the patient. The air fluidized bed is also shown to reduce bacteriological contamination .After each individual use, the bed and ceramic beads are decontaminated and sterilized[4,5,6].

In burn patient, there is insensible fluid and heat loss and hypermetabolism. When a burn patient is nursed in warm environment, it lowers the mortality by decreasing the metabolic response. Shivering and heat radiation is also reduced, this in turn spares the protein mass[7].

**Material And Methods**

The study was conducted at Burn Ward, Department of Plastic Surgery, UPUIMS, Saifai-Etawah during December 19 to December 20 over a period of one year. Total 37 patients were included in this

study. Patients with old burns and infected wounds were not included. Patients with co morbid conditions and preexisting diseases were also not included. Patients up to second degree burns are included. Patients with depth of burn more than second degree are not included. Patients with electric burn and chemical burns are also not included in the study. The age, severity of burn in terms of percentage, length of hospital stay, any surgical procedure undergone and mortality data was noted. Patients were assessed at the time of admission during hospitalization and at the time of discharge. Patients who showed unwillingness or those who refused to consent for being part of the study, patients below the age of 20 years and those with pre-existing psychological problems, pre-existing post burn sequelae and re-admitted patients were also not included in this study. At the time of admission baseline data is recorded as early as possible since the patient is admitted. Circumstances of injury were also enquired and recorded.

**Results**

All the patients admitted in the burn unit of department of plastic surgery, UPUIMS between September 2020 to December 2020 were included in this study. The total number of patients were 37. All the patients between the ages of 20-45 years were included in this study. All the patients with up to second degree burn were included in this study. Patients up to 60% TBSA burns are also included. Patients with co-morbidities are excluded from the study. The average age was 35 years. Females were 20 and males were 17 out of 37 patients. Average length of stay was approximately 17 days(Fig : 4).

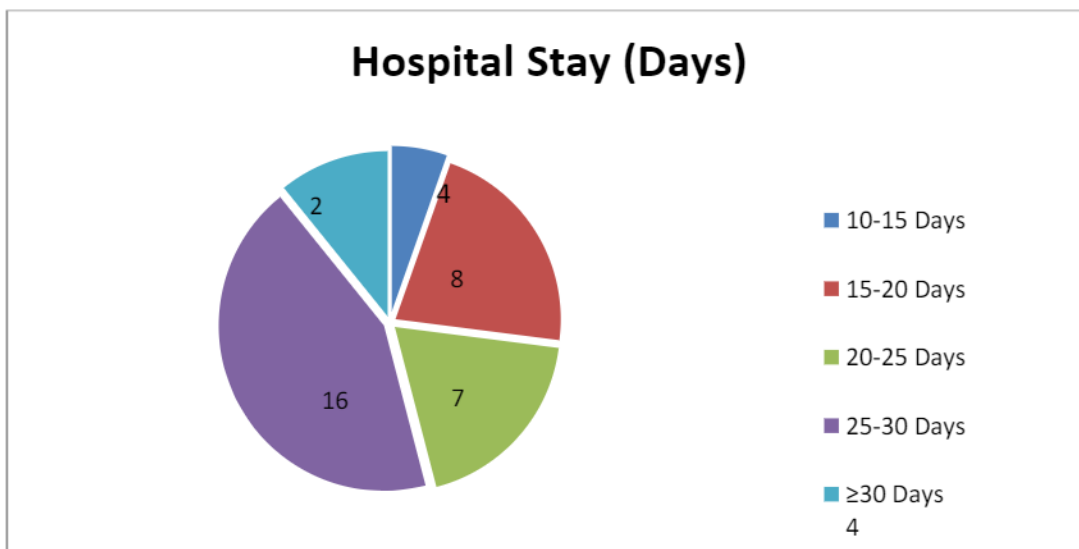


Fig : 4 Hospital Stay

Four patients not healed adequately and needed split skin grafting to cover the wound. Patients were divided in age groups of 20-30yrs,30-40 yrs,40-50yrs and 50-60 yrs(Fig 1).

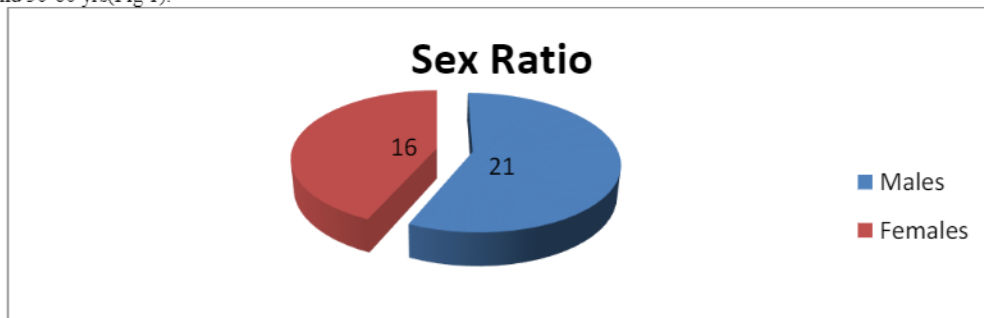


Fig : 1 Sex Ratio

In each age group there were 13,10,8 and 6 patients respectively out of which 8 males and 5 females (20-30 yrs),6 males and 4 females (30-40 yrs),3 males and 5 females (40-50 yrs) and 4 males and 2 females (50-60 yrs)(Fig 2 & Table .

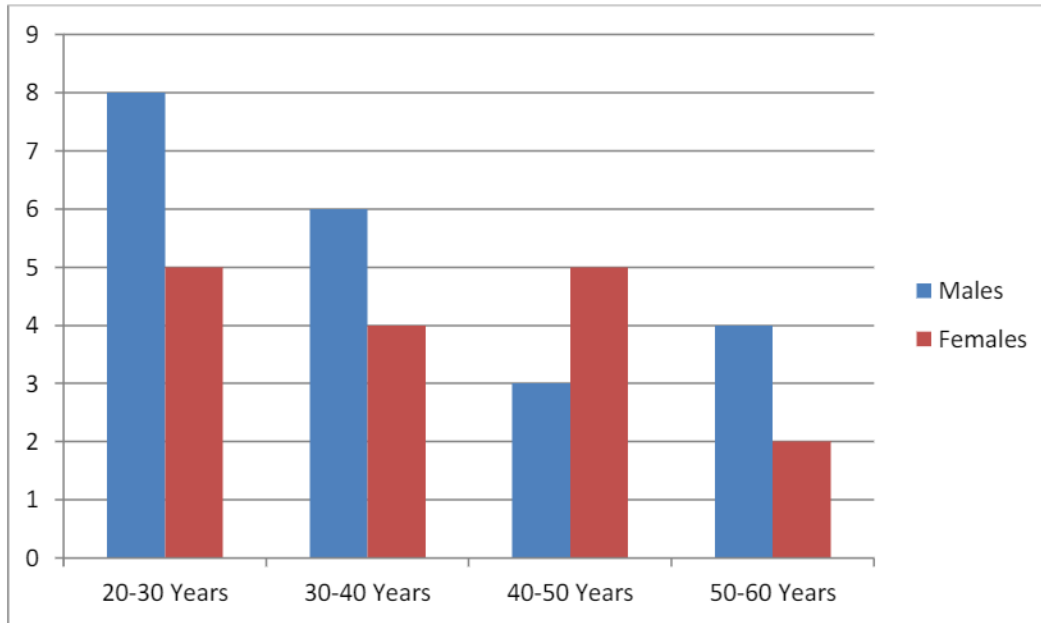


Fig : 2Age and Sex Distribution

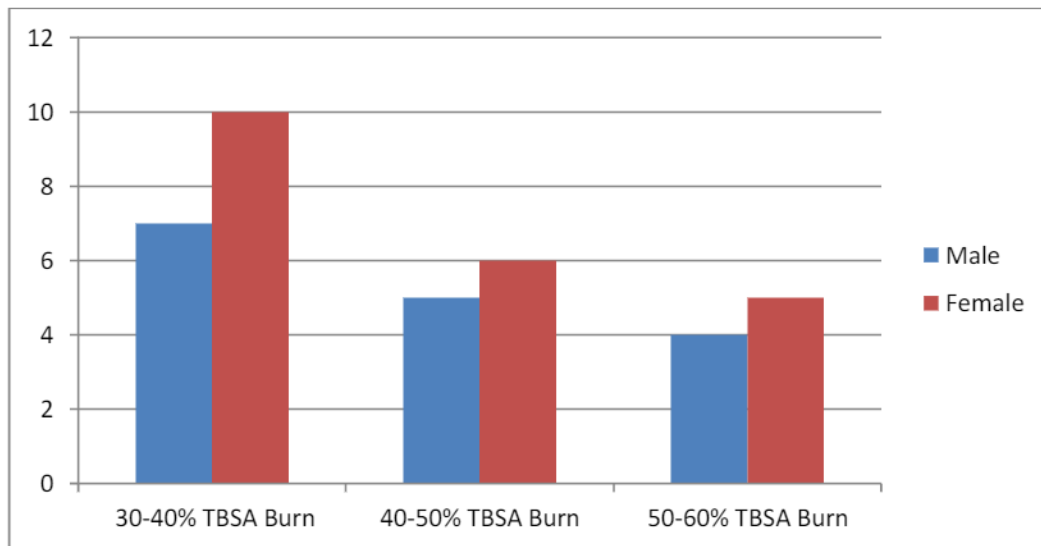


Fig : 3Percentage Burn and Sex Ratio

Table 1:Age and Gender Distribution

Age Group (Years)	Males	Females	Total
20-30	8	5	13
30-40	6	4	10
40-50	3	5	8
50-60	4	2	6
Total	21	16	37

Table 2: Percentage of burn distribution

TBSA Burn (%)	Males	Females	Total
30-40	7	10	17
40-50	5	6	11
50-60	4	5	9
Total	16	21	37

Table : 3 Hospital stay

Hospital Stay in days	No. of patients
10-15 Days	02
15-20Days	08
20-25 Days	07
25-30 Days	16
≥ 30 Days	04
Total	37

We found 17 patients in the range of 30-40%, 11 patients in the range of 40-50% and 9 patients in the range of 50-60% TBSA thermal burn. Hospital stay was also recorded; 16 patients required a stay of 5-10 days, 10 patients required 10-15 days, 7 patients required 15-20 days and 4 patients required more than 20 days of hospitalization.

#### Discussion

The aim of the study was to determine whether the air fluidized therapy is advantageous to the burn patients. Our results are comparable to the study done by Stefanie Nickl et al[8]. Pressure reduction is an important component in wound healing. Redistribution of pressure leading to improved circulation allows burn wounds to heal early. The patients were included in the study as per selection criteria. The study conducted between December 19 to December 20 at Uttar Pradesh University of Medical Sciences, Saifai-Etawah, INDIA which is a tertiary care hospital. The maximum number of patients were in the age group of 20-30 years. This may be because of more activity in this age group. The second common was the 30-40 years age group which is again due to similar reasons. Patients treated with air fluidized therapy had significantly better survival in contrast to the patients treated on conventional therapy. The better survival was attributed to this adjunctive therapy[8]. The patients were assessed after one month and three months after discharge from the hospital. The incidence of post burn contracture was significantly lower than compared to study. Similarly, the hypertrophic scarring was also less as there was smooth healing in most of the patients as compared to 30-41%. Acute stress was also less in comparison of an incidence in range of 40%[9].

Post traumatic stress disorder reported in different studies is ranging from 30% to 40% while in patients nursed on AFB in our study was less than 20%[9]. It is significantly less than these studies. As the patient has to stay less in the hospital and the patients can be discharged earlier, the incidence of psychological disorders like schizophrenia was also reduced.

Most patients returned to their work and were doing their job without fearful thoughts of the incidence, this is because the healing was smooth and incidence of post burn sequelae were also greatly reduced.

**Conflict of Interest: Nil**

**Source of support: Nil**

#### Conclusion

The wound healing in burn patients nursed on AFBs is faster than in conventional settings. It also reduces the psychological trauma like post traumatic stress disorder (PTSD) as well as the overall mortality. Our results indicate that AFT is highly beneficial adjunct in treatment of extensive burns. So, the patients nursed on AFBs have definitely better outcome and can be recommended for patients with extensive burns.

#### References

1. Vesley D, Hankinson SE, Lauer JL. Microbial survival and dissemination associated with an air-fluidized unit. *Am J Infect Control*. 1986;14:35-40
2. Boyland EA, Townsend TR, Horan T. Airborne contamination associated with the in-use air-fluidized beds: a descriptive study. *Am J Infect Control*. 1987; 15:75-783
3. Winters WD (1990) A new perspective of microbial survival and dissemination in a prospectively contaminated airfluidized bed model. *Am J Infect Control* 18:307-315
4. Scheidt A, Drusin LM. Bacteriological contamination in an air-fluidized bed. *J Trauma*. 1983;23:241-242
5. Gould K, Freeman R. Nosocomial infection with microsphere beds. *Lancet*. 1993; 342:241-242
6. Ryan DW. The fluidized bed 1: basic principles, bacteriology and wound care. *Intensive Care World* 7:92-96
7. Clark C, McConachie I, Edwards JD, Nightingale P. Concealed haemorrhage in patients nursed in an air fluidised bed. *Br Med J*. 1990;301:432
8. Stefanie Nickl, Alexandra Fochtmann-Frana, Jakob Nedomansky, Wolfgang Hitzl, Lars-Peter Kamolz, Werner Haslik. Air-fluidized therapy in the treatment of severe burns: A retrospective study from a burn intensive care unit in Austria. *Burns* 46(2020)136-142
9. Ashish Gupta. A Study of Clinical and Psychological Sequelae of Burns in 250 Patients. *Indian Journal of Burns* 2010;7(01)18 : 6-11