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AIR FLUIDIZED SUPPORT SYSTEM IN THE MANAGEMENT OF MAJOR BURNS

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SUMMARY : Thirty-two patients with major burns over the back of trunk and limbs were treated on the Air fluidized support system (Clinitron) and the results were compared with a control group of patients treated on conventional beds. It was found that in the group treated on Clinitron bed, mortality was lower, graft take was better, pressure sores did not develop and the patients were more comfortable. The results have been compared to similar studies. Though the initial investment and maintenance cost is very high, the device offers immense benefits, especially ease in nursing care.

INTRODUCTION

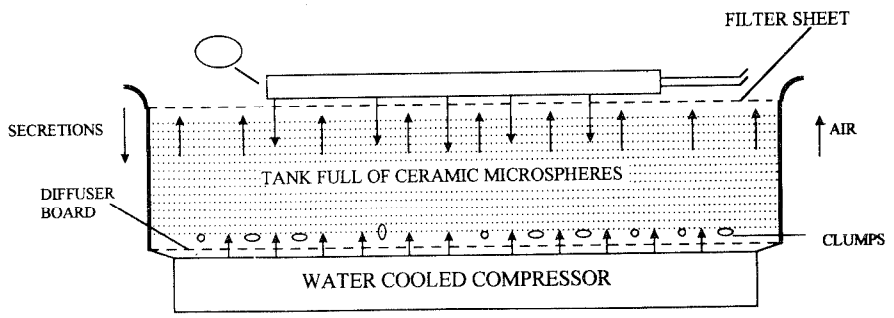
Extensive burns of the posterior aspect of the trunk and limbs have always been a major therapeutic challenge for the burn care facilities. The problems commonly encountered are painful supine position on conventional bed, high incidence of wound infection, pressure sores, loss of skin graft, discomfort caused by prolonged prone position and cumbersome nursing care. At the Burn Centre of the Tata Main Hospital, Jamshedpur we have been treating these patients on the Air Fluidized Support System (Clinitron) for the past five years. Our experience in managing patients with the Air Fluidized Support System, its advantages over conventional beds and improved outcome are presented along with a review of relevant literature. Sixty four patients with burns ranging from 20% total body surface area (TBSA) to 50% total body surface area (TBSA) were included in the study. One half of these patients (study group- 32) were treated on the Air Fluidized Support System (AFSS) and the other half (control group- 32) were treated on conventional beds. Parameters such as mortality, duration of hospital stay, development of decubitus ulcers, effect on burn wound healing, bactericidal effect of AFSS and effect on "take" of split skin grafts were studied and compared in both groups.

MATERIALS AND METHODS

The Fluidized system - The AFSS is a tank, which is full of silicone coated, ceramic soda lime glass microspheres, which gives the physical appearance of a free flowing white powder. A porous diffuser board forms the bottom of the tank. A powerful compressor is placed below this, which forcibly pumps controlled warm dry air through the tank containing the microspheres. A porous filter sheet covers this fluidized powder and the patient is nursed supine on it. Infected secretions from the patient pass through this filter sheet and become inspissated to form highly alkaline clumps, which settle at the bottom of the tank (Fig. 1).

A total of 64 patients between the ages of 10 years to 65 years were studied. Twenty two patients

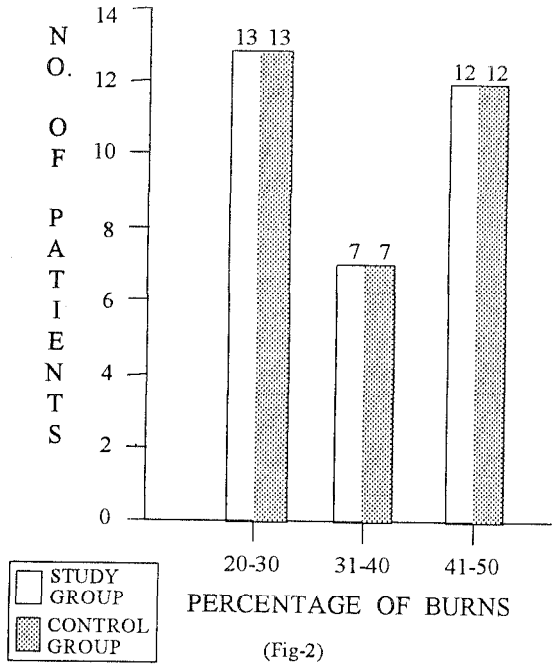
SCHEMATIC DIAGRAM OF AFSS



(Fig-1)

were males and 42 were females. Fifty-eight patients had sustained flame burns and the remaining 6 had scalds. They all had deep dermal and full thickness burns ranging from 20% TBSA to 50% TBSA. Patients having less than 20% TBSA or more than 50% TBSA were excluded from the study. Parts of the back, gluteal region and posterior aspect of lower limbs were involved in all the cases. Out of 64 patients, 32 were treated on the AFSS and a comparable 32 were treated on conventional beds. Thirteen out of 32 in each group had 20-30% TBSA burns, 7 patients of each group had 31-40% TBSA burns and 12 patients of each group had 41-50% TBSA burns (Fig. 2). The serum albumin level of patients of both groups ranged from 2.2 to 3.0 g/dl and the total proteins ranged from 4.5 to 6.0 g/dl indicating mild to moderate malnutrition. None of the patients had any significant associated illness. Excepting one patient in the study group who had bilateral fracture of calcaneus, no other patient had any associated injury in either group. Patients with smoke inhalation injury were excluded from the study.

COMPARISON OF PERCENTAGE TBSA OF STUDY AND CONTROL GROUP



(Fig-2)

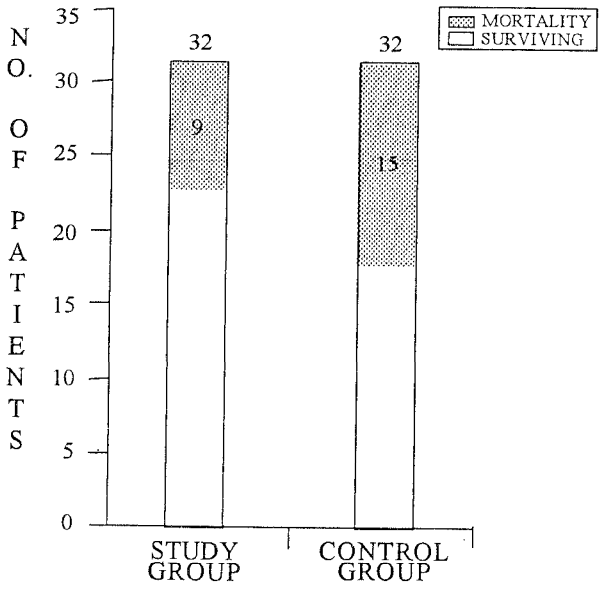
Patients of both groups were treated in our burn centre by the same personnel and according to a uniform treatment protocol. After the initial resuscitation on a conventional bed, patients of the study group were nursed on the AFSS from the third to fifth day post-admission. The patients of the control group were nursed on conventional beds. Staged debridement was done on separation of eschar and split thickness skin grafts were applied to the granulating area in one or more sittings in patients of both groups. Patients who were treated with the AFSS were nursed on it between 3rd to 5th day after admission to 7-10 days after skin grafting. Dressings were done with autoclaved Furazolidine impregnated gauze in the study group. Patients of the control group were dressed conventionally with Silver Sulphadiazine cream and Gamjee pads. Silver Sulphadiazine cream and Povidone iodine solutions are contraindicated in patients nursed on the AFSS because of its adverse effect on the silicone coating of the ceramic microspheres. Surface cultures were taken on the fourth to sixth day post burn and then repeated every week in patients of both groups. Microspheres and inspissated clumps from the bottom of the tank were also cultured periodically for the presence of microorganisms. Nutritional support was provided by nasogastric tube feeds. Blood transfusions and antibiotics were administered according to existing protocol and physiotherapy was given to patients of both groups.

RESULTS

Parameters for evaluating the results were mortality, average hospital stay, incidence of graft loss, development of pressure sores and comfort level of the patient.

Nine out of 32 patients treated on the AFSS died (28.13%), as compared to a mortality of 15 out of

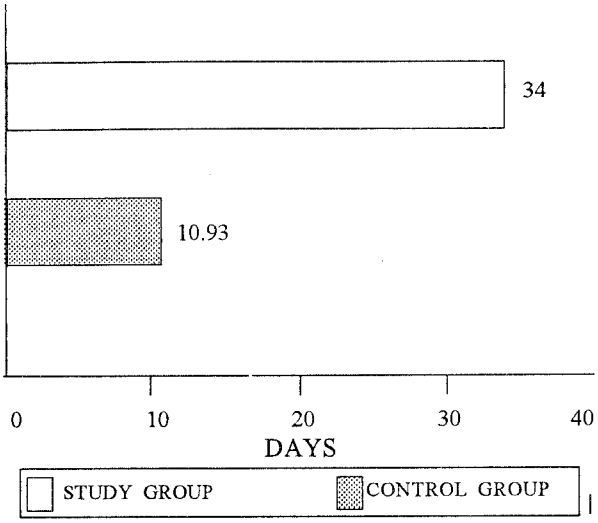
COMPARISON OF MORTALITY IN THE STUDY GROUP AND THE CONTROL OF PATIENTS



(Fig-3)

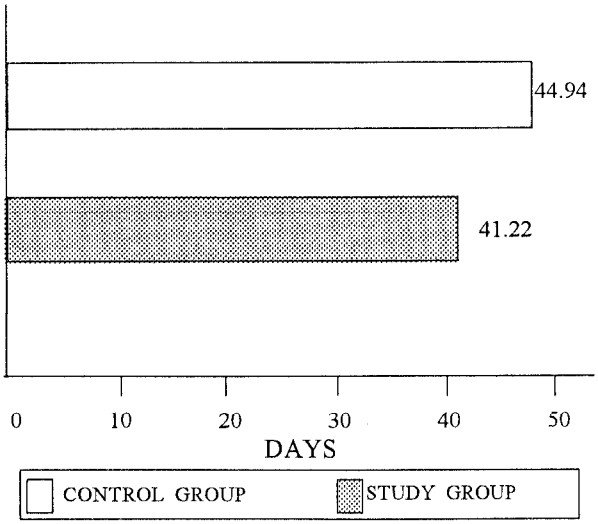
32 (46.85%) in the control group (Fig.3). In the non-surviuors the average period of survival in the study group of patients was 34 days as against 10.93 days in the control group (Fig.4). The average hospital stay in the patients of the study group was 41.22 days as against 44.94 days in the control group (Fig.5).

COMPARISON OF PERIOD OF SURVIVAL IN NONSURVIVORS



(Fig-4)

COMPARISON OF AVERAGE HOSPITAL STAY IN SURVIVORS



(Fig-5)

Surface cultures became positive for microorganisms from the fourth to sixth day after admission in all the patients of both groups. The most common infecting organisms were Staphylococcus aureus (Coagulase positive) and Pseudomonas aerugenosa, either alone or in combination, in patients of both groups. Repeated cultures of the microspheres and inspissated clumps from the bottom of the tank were found to be sterile.

None of the patients treated on the AFSS developed pressure sores whereas two patients developed pressure sores in the control group. The burn wounds of the patients in the study group had significantly less soakage and were relatively dry as compared to the patients of the control group. The patients grafted on posterior wounds could comfortably lie supine on the AFSS in the post-operative period but patients of the control group had to be kept strictly in the prone position after grafting on the conventional beds. The overall incidence of graft loss was much higher in the control group as shown in Table 1.

TABLE 1

POST-OPERATIVE LOSS OF SKIN GRAFT

	No.of Patients	No.of Patients grafted	No.of Patients with partial graft loss	% of Patients with partial graft loss
AFSS group	32	26	5	19.23
Control group	32	21	9	42.86

Twenty seven patients out of 32 had no complaints regarding AFSS but the remaining five patients complained of a sinking feeling and were not comfortable.

DISCUSSION

The most important finding of this study was that the mortality of the study group of patients was significantly lower as compared to the control group of patients. These findings are consistent with similar trials conducted in Japan and Milan[1,2]. In the Milan study the mortality of the AFSS group of patients was 27% as against 39% of the control group. It may be prudent to assume at this point that the chances of survival of some of the study group of patients could have been better.

The average hospital stay of the patients of the control group was only marginally higher than the study group. This is also consistent with similar reports from the Milan Burn Centre trial[2].

The draft of warm dry air over the back of the patient helps in drying of the wounds and thereby minimizes infection. Moreover infected secretions from the patients, which pass into the tank, are rapidly inspissated into alkaline clumps and settle at the bottom. These clumps are sterile on repeated

cultures, thereby proving the bactericidal effect of the AFSS. This is consistent with similar studies conducted in Sweden, Baltimore (USA) and University of South Carolina (USA)[3,4,5]. One study from the USA has reported that the AFSS could be a potential source of nosocomial infection because of positive culture reports obtained from the microspheres when used for heavily infected patients[6]. To minimise the possibility of such nosocomial infection the AFFS should be fluidized for at least 48 hours before using it for a new patient. The warm dry ambience facilitates cutaneous vasodilatation and expedites healing. For the same reason conversion of deep dermal to full thickness burns is less with AFFS[4,8,11].

Floatation facilitates a uniform distribution of the weight of the patient over the entire back. Hence, no pressure sores were seen to develop in patients treated on AFSS[4,7,8].

Patients grafted on posterior wounds were comfortable when made to lie supine on the AFSS. This position was more acceptable to the patient than a prone position on a conventional bed. The incidence of partial graft loss was lower in the patients nursed on the AFSS because of better immobilisation of grafts and less maceration. The uncomfortable sinking feeling complained by five of our patients has also been observed in a French study[9]. However reports from other centres state that most patients are comfortable on AFSS[4,7,10].

In patients treated on the AFSS, nursing is very convenient since no special back care or frequent change of posture is necessary[8,10,12]. One disadvantage of AFSS is that it is difficult to mobilize the patients because the air fluidization has to be switched off and the patient helped out of the high bed. Newsome, Johns and Pruitt[8] recommend shifting the patient back to a conventional bed in order to facilitate ambulation. In our centre, we follow this practice.

It is a well-established fact that the AFSS increases the insensible losses of fluids from the patients due to increased evaporation[4,13]. In order to reduce this risk, the early resuscitation of the patients in burns shock was carried out on a conventional bed and then were shifted to the AFSS only on the third or the fourth day after admission, when they become haemodynamically stable. Once on the AFSS, the hourly urine output was taken as an important parameter of adequacy of hydration. However, no patient in our series developed dehydration while on AFSS.

Cost and Maintenance : The most important deterrent factor in procuring this device is the enormous initial cost i.e. approximately Rs.20, 00,000/= (Twenty lakhs). Depending upon the frequency and length of use, the silicone microspheres usually need to be changed every year at a cost of about Rs.100,000/-. The filter sheets will also need to be changed once or twice a year which costs about Rs.15,000/- each. There has to be an uninterrupted cold water supply to cool the compressor at the bottom of the bed. The bed of the tank has to be cleaned to remove the sediments from the bottom by sieving the microspheres. Therefore, the device demands regular maintenance by trained personnel, besides the cost factor. However, when compared with the benefits of reduced mortality, reduced incidence of infection, better wound healing, easier nursing and better patient comfort, the device may be justifiable in some specialized centres.

CONCLUSION

The Air Fluidized Support System is a facility, which can be gainfully utilised in the treatment of major burns. Its main advantages are reduced mortality, reduced incidence of infection, better wound healing and easy nursing. But these have to be carefully weighed against the high initial investment and maintenance cost. We recommend this device for well equipped, specialised burn care centres.

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