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HEPARIN IN THE MANAGEMENT OF EXTENSIVE BURNS

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SUMMARY

The severe burn injury patients (more than 40%) were studied in two randomized groups. Both groups were treated similarly except that one group received heparin both topically and systemically. Significant relief of pain, early healing in cases of superficial and deep dermal burns without hypertrophic scarring and contracture formation, early separation of eschar, excellent graft take in full thickness burns were few of the important advantages observed in heparin group patients. Significant decrease in the incidence of respiratory complications, septic shock and decreased mortality were also noticed in patients receiving heparin. The only disadvantage being that the doses required are quite heavy. No complications in the form of bleeding disorder, despite heavy dosages have been observed.

Severe thermal burn injury is a complex disease process and is still a challenging field in medical science in which a lot can still be explored. The underlying local and systemic body changes are much more complicated than in a case of simple surgical trauma. Virtually all known systemic, physiological, biochemical, metabolic and immunological problems of burn patients can be directly traced to various physiopathological changes in burns.

Oligaemic shock leading to increased cardiac activity is due to extensive loss of plasma from the local burn tissues. Similarly the pain of local wound leads to neurogenic shock as a systemic manifestation. Reduced microcirculation and release of proteolytic enzymes from the burnt tissues lead to extension of burn wound in late phases. The proteolytic enzymes have systemic manifestation attributable to previously known burn toxemia. Since Heparin is known to help in reducing all the aforesaid systemic manifestations (Saliba, 1967, 1970) by improving micro-circulation, stabilizing the cell membrane thereby reducing the plasma loss and neutralizing the burns toxins (mainly proteolytic enzymes, serotonin and histamine). So it was decided to conduct the present study.

Material and Methods

This study was conducted in the Burns, Plastic and Maxillofacial Surgery Deptt., Safdarjang Hospital, New Delhi. We receive approximately 5,000 burn cases annually out of which 600 extensive burn patients require admission. The study was conducted on randomly selected extensive burn patients (more than 40%). We have used heparin in 25 cases both topically and systemically. The results have been compared with the control group having the same extent of burns. Patients having history of peptic ulcer and bleeding diathesis were excluded from our study.

Systemic Route

Initial dose of heparin was calculated as 10,000 units/10% burn area. The dose was repeated every 4-6 hourly. Relief of pain, subsidence of erythema and odema were the factors observed for titration of heparin administration. If these were not noted, the dose of heparin was increased to the maximum permissible dose of 300-400 units/15% burn/kg body weight to obtain a clinical response.

Topical Application

After maping out the areas according to the depth and extent of burn in the chart used by us (Fig. 1), the heparin was applied in the form of heparin soaked gauge pieces. The dose being 25,000 units/10% burn under aseptic

conditions in the operation theatre. The burnt areas were cleaned, blisters fluid aspirated and heparin soaked gauge pieces applied and left as such for 30 minutes. Then silver sulphadiazin was applied over it, and wounds were covered with absorbent dressings (Gamgee pads) (Fig. 2). The dressing has to be changed every alternate day till the deep dermal burns heal completely or the areas become fit for skin grafting.

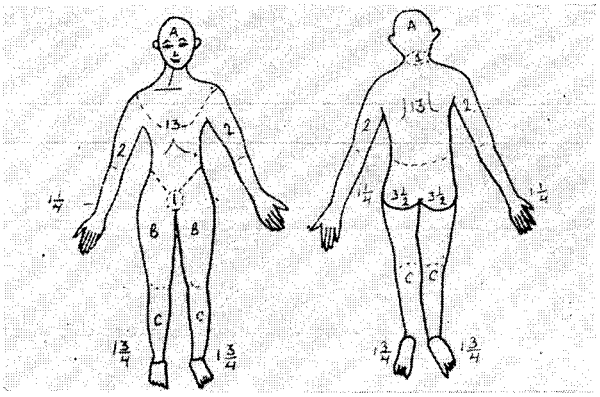

Fig. 1. Burns Chart for mapping burn areas.

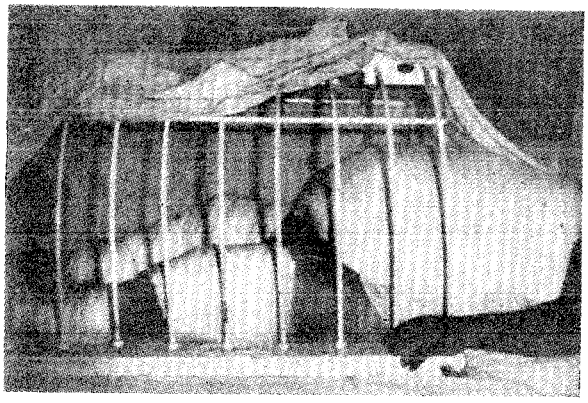

Fig. 2. A case of extensive burns after closed dressing with heparin.

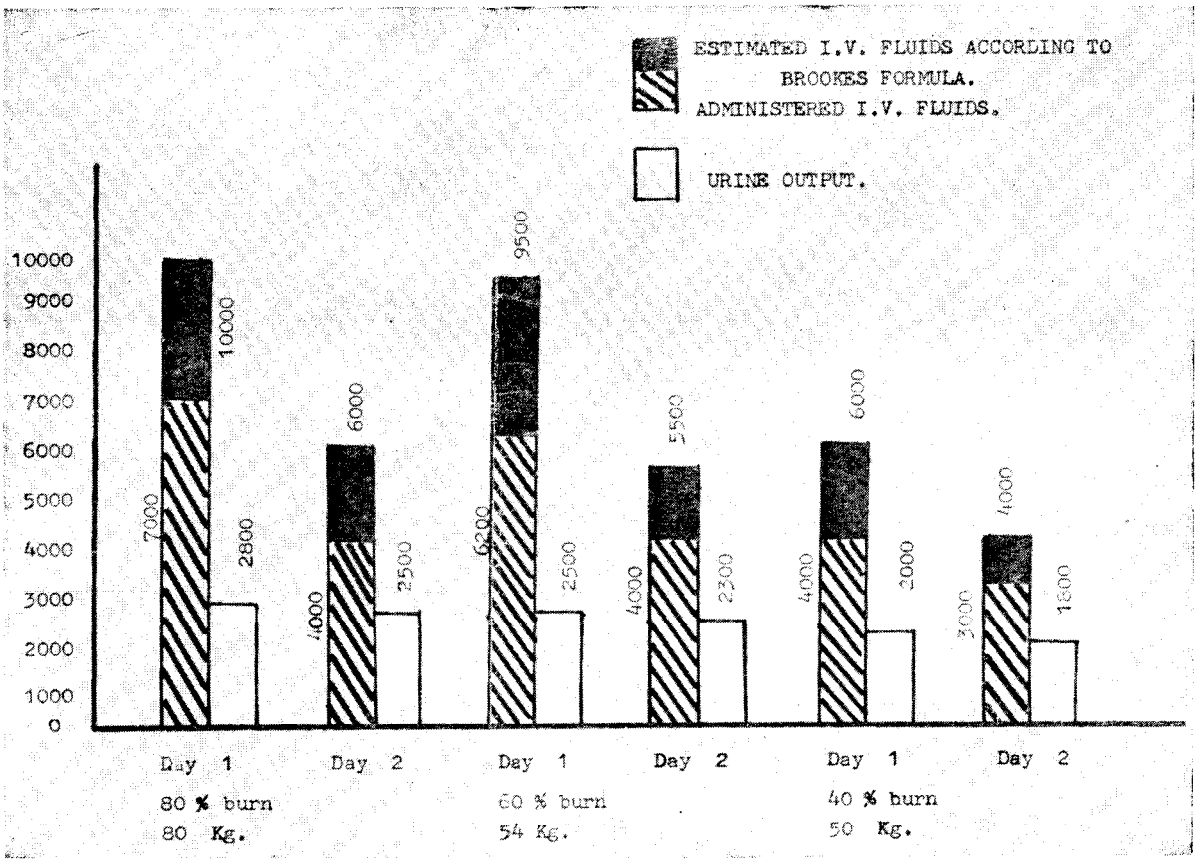

Fig. 3. Bar diagram showing first 48 hours fluid requirement shown in both control and heparin group.

Increase in bleeding time for more than 60 minutes or any bleeding tendency in the form of haematuria, hematemesis or persistant oozing from the raw area were the criteria to stop heparin regime immediately. No specific investigation like complete coagulation profile was necessary. Daily estimation of bleeding and clotting time, urine for microscopic haematuria and stool for occult blood were routinely examined in both the groups.

The cases in the control group were treated on the same lines in the form of dressing with Silver Sulphadiazine except that they were not given heparin in any form.

Wound swab and blood for culture and sensitivity were being sent routinely, every alternate day and once a week respectively in both the groups.

Observations and Discussion

In both the groups majority of patients studied were of more than 20 years of age. Maximum age of the patient studied was 55 years and the youngest patient was of 8 years (Table I).

Table I. Age and Sex Ratio

Age group in years	Control group		Heparin group	
	M	F	M	F
0—10	1	1	1	1
11—20	1	1	1	1
21—30	2	3	3	4
31—40	4	3	2	4
41—50	5	2	2	2
>50	1	1	2	2
Total	14	11	11	14

The fluid administration in heparin group was titrated so that the urine output was around 1.0-1.5 ml/kg/hour. The fluid requirement in control group was estimated according to the modified Brook's formula in the present study. As heparin stabilizes the cell membrane and neutralizes some other factors like prostaglandins which are responsible for increased capillary permeability in the burn patient by its anti-prostaglandin activity, thereby the fluid loss will be comparatively less in patients receiving heparin compared to the control group. (Mc Cleery, 1949) This is the reason that patients receiving heparin required only 2/3 amount of the estimated volume (Fig. 3).

Various organisms were isolated in both the groups. The infection rate has been decreased significantly (40-50%) in patients treated with heparin as compared to control group. Pseudomonas aerogenosa and Klebsiella groups were the commonest infective organisms in most of the patients in both the groups (Table II).

Table II. Type of organisms isolated

Organism	Wound swab culture		Blood culture	
	Control group	Heparin group	Control group	Heparin group
Esch. coli	6 (24%)	2 (8%)	3 (12%)	—
Ps. aerogenosa	16 (64%)	9 (36%)	6 (24%)	3 (12%)
Klebsiella	5 (20%)	5 (20%)	3 (12%)	2 (8%)
B. Proteus	4 (16%)	2 (8%)	1 (4%)	
Staphylococci	8 (32%)	4 (16%)	2 (8%)	1 (4%)
Streptococci	6 (24%)	2 (8%)		
Others	5 (20%)	4 (16%)		

Because of improved microcirculation with heparin, the cell defence mechanisms were geared to meet the challenge from the infecting organisms. Hence the infection rate is controlled in the contamination stage itself.

Superficial and deep dermal burns healed in a record period of time in patients treated with heparin. In superficial burns it took 6 days to heal in the heparin group as compared to 10 days in the control group. In deep dermal burns the healing time was 15 days in the heparin group as compared to 28 days in the control

group (Table III) (Fig. 4). In full thickness burns, slough separation started very early in patients receiving heparin (12th day in heparin as compared to 3 weeks period in the control group). Most of the areas were made fit for grafting by 20th day in heparin group (control group took 36 days). Graft take was almost cent percent in the heparin group as compared to 65% in the control group (Table III) (Fig. 5, 6).

Table III. Healing pattern both in control and heparin group

Type of burn	Average time of healing	
	Control group	Heparin group
Superficial	10 days	6 days
Deep dermal	28 days	15 days
Full thickness Eschar separation	21 days	12 days
Raw area fit for grafting	36 days	20 days
Graft take	65%	95%

The skin adenexal elements present in the deeper layers of skin were made to survive by the vasodilatory and anti-thrombin effects of heparin (Lahvilla, 1986). Epithelization by proliferation of these survived epithelial island cells is induced with heparin thus making superficial and deep dermal burns to heal in a record period of time.

As the microcirculation improves the demarcation between the viable and non-viable cells becomes very rapid thereby slough separation occurs very early (Johansons, 1964) In addition to this the formation of granulation tissue will be hastened by the vasodilation

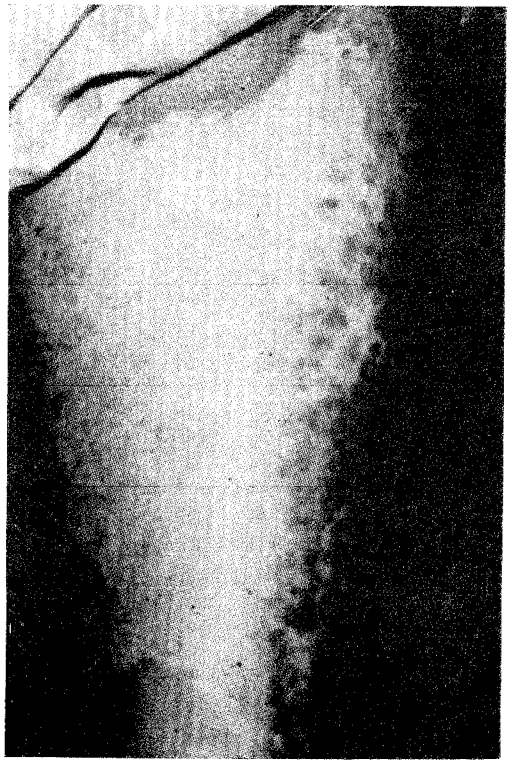

Fig. 4. Extensive burns on 18th day after heparin dressing—Superficial and deep dermal burns healed completely.

Fig. 5. Burn on 28th day after heparin dressing—full thickness burn ready for skin grafting after complete slough separation.

Fig. 6. Almost cent percent graft take of raw area in patient treated with heparin, adjacent scars were of healed deep dermal burns.

Fig. 7. A 45 years diabetic female with 80% burn who recovered completely within 1½ months including grafting for unhealed 15% area.

induced by heparin. The same vasodilation phenomena also explains the excellent graft take in patients receiving heparin.

The incidence of thrombophlebitis in patients receiving heparin was 7 times lower than the control group. Septicemia, Acute Respiratory Distress Syndrome and renal complications were decreased to 60% (Table IV). Thrombophlebitis which was controlled significantly by the anti-thrombin

Table IV. Complications

Complications		Control group	Heparin group
Wound infection		25 (100%)	20 (80%)
Thrombophlebitis		20 (80%)	3 (12%)
Septicemia		14 (56%)	6 (24%)
Respiratory		15 (60%)	6 (24%)
Renal	UTI	12 (48%)	5 (20%)
	Failure	2 (8%)	0 (0%)
DIC		2 (9%)	0 (0%)

effect of heparin (in addition to decreasing the wound infection) also decreases the incidence of septic shock and ARDS. Heparin also helps to minimize the aforesaid complications as under:—

(a) It stabilizes the cell membrane of alveolar capillaries and thereby interstitial pulmonary odema gets decreased.

(b) The formation of thrombus will be decreased by the anti-thrombin effect of heparin.

(c) By improving the pulmonary circulation with heparin, the surfactant component which is vital for the compliance of the lung will be saved.

(d) By the anti-histaminic, anti-serotonin, anti-proteolytic enzyme and anti-prostaglandin activities, heparin neutralises the many mediating factors responsible for the pathogenesis of septic shock and ARDS. Inspite of using heparin in high dosage, we have not encountered any bleeding diathesis or DIC in our study.

Table V. Relationship between Percentage of burns and mortality both in control group and heparin group

% of burns	No. of cases studied		Mortality rate	
	Control group	Heparin group	Control group	Heparin group
40%—50%	11	9	2 (18%)	Nil
50%—60%	7	8	3 (43%)	1 (12.5%)
60%—70%	4	5	3 (75%)	1 (20%)
70%	3	3	3 (100%)	1 (33.3%)

Mortality was 12% (3 out of 25) in heparin group compared to 44% (11 out of 25) in the control group in the present study. All patients having more than 70% burn died in the control group, whereas it was one out of three in the heparin group. No patient with 40-50% expired in heparin group whereas the mortality was 18% in the control group (Table V) (Fig. 7).

Conclusion

The incidence of wound infection, pain, thrombophlebitis, septicemia and ARDS were decreased in patients receiving heparin, hence the mortality was low in this group. Patients receiving heparin required lesser amount of fluids and healed faster.

Surprisingly there were no contractures in cases receiving heparin inspite of deep burns extending across the joint line. This could be due to early healing of the wounds and lack of the fibrous tissue formation or may be due to the alteration in the remodeling of the newly laid down collagen tissue (Fig. 8).

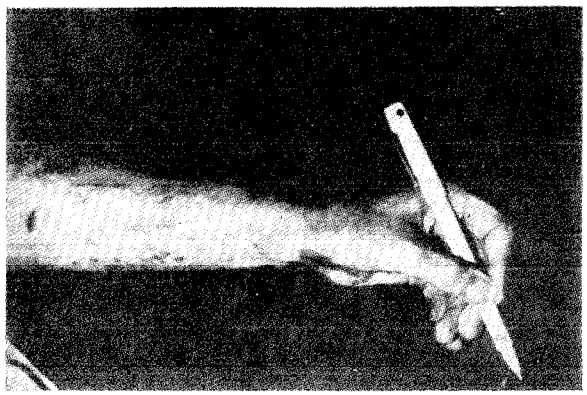

Fig. 8. The same patient, photograph of hand, showing full function without contracture with soft supple scar inspite of deep burns.

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