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EVIDENCE AGAINST PARTICIPATION OF MAST CELL HISTAMINE IN FORMATION OF BURN WOUND EDEMA

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HISTAMINE HAS been implicated as a mediator of edema formation in injured tissue. That this mediator participates in the inflammatory response to injury is suggested by data showing increased levels of plasma histamine during the time of edema formation after burn which are proportional to depth and size of injury (1). Because the mast cell is the principal source of tissue histamine, the contribution of this cell to edema formation in rats with a standard 30% total body surface area (TBSA) partial-thickness burn was investigated. Degranulating the mast cells prior to burn injury evoked no difference in the amount of edema formed compared with that in rats with normal mast cells. Substantially lower systemic levels of histamine were observed in the plasma of this group of rats after burn injury, which confirmed that degranulation of mast cells affected histamine concentrations.

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MATERIALS AND METHODS

Rats were anesthetized with pentobarbital and immersed in 95-C water for two seconds. Fluid in the burn wound was calculated from the wet weight of two skin biopsies (3 to 5 gm each) from each rat and the weight of the skin after drying for 72 hours at 75 C and reported as percent water. On the basis of the measurement of burn edema at 12 times between five minutes and eight hours postinjury in 55 rats, the five-minute and four-hour time points were selected for further investigation.

The mast cells of one group of rats were degranulated by a three-day pretreatment with polymyxin B administered intraperitoneally. Blood for plasma histamine determination was drawn into citrate in 200-μl volumes from central venous cannulas inserted the day prior to the experiment. Plasma histamine was measured with double-label radioenzymatic assay (2). Mast cells were enumerated in Giemsa-stained tissue sections by counting all vessels and mast cells in 10 hpf.

RESULTS AND DISCUSSION

The number of mast cells identified microscopically four hours postinjury was significantly reduced by pretreatment with polymyxin B in both sham and burned rats when compared with rats given saline, but edema was not different (Table 1). These data combined with those of two additional experiments showed that burned rats treated with polymyxin B ($N = 16$) and saline ($N = 16$) had 0.197 and 1.58 mast cells/vessel, respectively. Even though the rats treated with polymyxin B had almost a 90% decrease in mast cells, their tisssue contained the same percent of water as saline-treated controls (71.05 ± 0.42 and 71.28 ± 0.26, respectively). At five minutes after injury both rats pretreated with polymyxin B and saline developed significant amounts of edema when compared with controls ($P < 0.04$). However, percent tissue water content between these groups was not significantly different ($P > 0.05$), with increases of 1.66% ($N = 6$) and 2.23% ($N = 6$), respectively. That histamine stores were depleted was confirmed by the fact that central venous plasma histamine rose from 8.79 ± 0.86 to 77.58 ± 27.28 and 74.22 ± 32.70 ng/ml at

Table 1—Results of pretreatment with saline and polymyxin B in sham-injured and burned rats four hours postinjury

Injury	N	Pretreatment	% Water	Mast cells/vessel
Sham	5	Saline	64.71 ± 0.24 (SEM)	1.97 ± 0.16 *
Sham	5	Polymyxin B	64.01 ± 0.21	0.70 ± 0.17
Burn	5	Saline	71.41 ± 0.46 NS	1.67 ± 0.22 †
Burn	5	Polymyxin B	70.62 ± 0.51	0.27 ± 0.05

*$P < 0.01$; † $P < 0.001$, one-way ANOV.

one and two minutes postburn, respectively, in the saline-pretreated rats but only from 10.75 ± 6.18 to 20.33 ± 14.37 and 19.62 ± 13.29 at these times in rats pretreated with polymyxin B. Additional studies showed that the plasma histamine of rats pretreated with saline (N = 6) increased sixfold 30 minutes postinjury, whereas in polymyxin B-treated rats (N = 5) the increase was only twofold ($P < 0.001$).

CONCLUSION

Significant degranulation of mast cells with depletion of histamine stores does not alter formation of edema after thermal injury in the rat.

REFERENCES

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