

Enkephalin content in rat hypothalamus – effect of adrenalectomy, laparotomy and corticosteroid treatment

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Opioid agonists and antagonists alter stress-induced corticosterone secretion in mice suggesting the involvement of endogenous opioids in the hypothalamus-pituitary-adrenal (HPA) axis (Gibson, Ginsburg, Hall & Hart, 1977). We have extended these observations by measurement of rat hypothalamic enkephalin content after manipulation of the HPA axis, using the extraction and assay procedures of Hughes, Kosterlitz & Smith (1977).

In two series of experiments enkephalin levels fell initially after both adrenalectomy (ADX) and sham operation but the repletion of enkephalin was more rapid in intact rats. The most striking changes seen after ADX occurred in experiments which are excluded from Table 1; in 9 out of the 69 hypothalamic extracts from ADX rats the vas deferens response was atypically prolonged. This was not seen in any of the 97 extracts from intact rats. Levels of this atypical opioid were variable and in terms of met-enkephalin equivalentsoften very large – as much as 60 µg/g. Fur-

ther analysis showed this opioid was not a peptide, had an apparent mol. wt. of 600 and its sensitivity to naloxone paralleled that of met-enkephalin on the vas deferens.

Treatment of unoperated rats with either dexamethasone (5×10^{-5} M in drinking water for 24 h) or corticosterone (10 mg/kg s.c. in vegetable oil, 24 h before killing) caused a 30–40% increase in hypothalamic enkephalin. Laparotomy 18 days after ADX failed to reduce enkephalin levels 24 h later, in contrast to the observation in intact animals (Table 1).

These results suggest that hypothalamic enkephalin is involved in laparotomy stress; that glucocorticosteroids may participate in short-term regulation of enkephalin in some hypothalamic neurones; and that an atypical, non-peptide opioid may be involved in this regulation.

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References

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Table 1 Enkephalin content of hypothalamus in sham operated and adrenalectomised (ADX) rats

		24 h	3 day	6 day	11 day	18 day
Series I						
	Sham		397 ± 32 (9)†*	1297 ± 130 (6)*	576 ± 132 (6)	717 ± 55 (6)
Control 671 ± 30 (10)	ADX		510 ± 32 (8)†*	570 ± 73 (6)†*	905 ± 83 (8)†	1160 ± 308 (5)
Series II						
	Sham	613 ± 75 (6)†	1114 ± 79 (8)	1180 ± 136 (8)*	779 ± 84 (9)	1003 ± 89 (8)
Control 940 ± 63 (21)	ADX	511 ± 41 (6)†	976 ± 109 (9)	765 ± 103 (7)*	922 ± 81 (10)	927 ± 76 (8)

Ng met-enkephalin equivalents g⁻¹ net weight ± s.e. mean. Number of animals in parentheses. † test, sham 11 ADX, **P*<0.05; control vs operated, †*P*<0.05.