Effect of catecholamines on bursa of fabricius in chicken

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Effect of catecholamines are studied on the bursa of fabricius of chicken. It is found that in epinephrine (E) treated chicken, the lymph follicles are slightly decreased in size. Some amount of nuclear pycnosis is visible in E and norepinephrine (NE) treated chicken. There is no change in the bursa weight and histology in NE treated groups. No deviation is observed in the level of DNA, RNA, total protein and sialic acid content of catecholamine treated birds.

Unidirectional inhibitory effects of NE or some mimetic drugs provoke changes in metabolism which in turn results in various functional alterations of immunocompetent cells 1. Ficek 2 worked on epinephrine (E) action on rats and observed involution of the cortical and medullary parts of the thymus. Initially free spaces formed in the gland, and later, particularly in the cortical part, connective tissue of compact character developed. However, in the case of bursa of fabricius, unlike thymus and other mammalian immunosystem, the mechanism of its interactions with catecholamines is unknown. In view of this, present study has been undertaken to probe into the action of E and NE on the histology, histochemistry and biochemistry of bursa of chicken with special emphasis to DNA, RNA, total protein and sialic acid. DNA, RNA, total protein and sialic acid levels of bursa of chicken are measured earlier and revealed interesting changes after glucocorticoid treatments 3-4.

Day 1 old chicken (Gallus domesticus) were separated into three groups (10 individuals in each group). L-Epinephrine-bitartrate (Adrenaline-bitartrate) from Sigma, USA was administered to group II birds. Group III birds received L-arterenol bitartrate (L-norepinephrine bitartrate) from Sigma, USA. All hormones were administered intramuscularly and at dosage of 0.006 mg/day/kg body weight for six consecutive days, i.e from 4th to 9th day. Group I received saline vehicle and served as control. Animals were sacrificed after 24 hrs of last (hormone/vehicle) injection administered by cervical dislocation.

Day 11 old chickens were also divided into three groups (12 individuals in each group) and the experiments were carried out from 15th to 20th day in an identical manner to that of day 1 old chicken. For histological studies, section of bursa (4 μm) was stained with Masson’s trichrome technique.

Histological observation of DNA was made by fixing the tissue in Carnoy’s fixative for Feulgen reaction (see Pearse) 5 for microscopic observations. RNA and DNA were quantitated by pentose analysis 6 and protein was estimated by the method of Lowry et al 7. Sialic acid level was estimated by the method of Warren 8. Data were analysed statistically by Student’s t test 9.

In E treated chicken, the absolute and relative bursa weight were decreased. NE treated birds did not exhibit any change in the histology of the bursa. In E treated chicken, the lymph follicle slightly decreased in size. An interesting observation made in some follicles of E treated birds. Compactness of medullary cells decreased by parenchymal disorder and forming irregular spaces (Fig. 1).

Nuclei of all the cells of bursa of fabricius showed positive response to Feulgen reaction. Decreased reactivity of DNA after Feulgen reaction was noted in E treated groups. A little decrease in reactivity in NE treated chickens was noticed. Some amount of nuclear pycnosis was visible in day 10 and 21 old E and NE treated chickens (Figs. 2a & b). Total number of both cortical, medullary nuclei of E and NE treated groups also exhibited numerical reduction (Table 1).

Level of DNA, RNA, total protein and sialic acid of bursa were estimated from day 10 and 21 old
Table 1—Bursa weight, level of DNA, RNA, total protein, sialic acid along with changes in the number of nuclei of bursa of fabricius of catecholamine treated chickens
[Values are mean±SE]

<table>
<thead>
<tr>
<th>Age</th>
<th>Treatment (n)</th>
<th>Bursa wt</th>
<th>Concentration</th>
<th>Total no. of nuclei after Feulgen stain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Absolute (mg)</td>
<td>Relative (mg/100g)</td>
<td>DNA (µg/mg)</td>
</tr>
<tr>
<td></td>
<td>C (10)</td>
<td>90.30 ±1.57</td>
<td>191.31 ±1.02</td>
<td>6.41 ±0.50</td>
</tr>
<tr>
<td>Day 10 old</td>
<td>E (10)</td>
<td>80.32 ±3.21</td>
<td>173.85 ±4.50</td>
<td>5.98 ±0.85</td>
</tr>
<tr>
<td></td>
<td>P &lt; 0.025</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>NE (10)</td>
<td>88.89 ±1.39</td>
<td>191.90 ±1.55</td>
<td>6.32 ±0.63</td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>C (12)</td>
<td>285.30 ±3.57</td>
<td>245.29 ±2.33</td>
<td>6.20 ±0.05</td>
</tr>
<tr>
<td>Day 21 old</td>
<td>E (12)</td>
<td>271.31 ±3.35</td>
<td>235.26 ±2.03</td>
<td>5.99 ±0.89</td>
</tr>
<tr>
<td></td>
<td>P &lt; 0.010</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>NE (12)</td>
<td>280.50 ±2.51</td>
<td>244.45 ±1.23</td>
<td>6.01 ±0.32</td>
</tr>
<tr>
<td></td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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</tr>
</tbody>
</table>

* Dose=0.006 mg/day/kg body wt and duration—6 consecutive days.

Fig. 1.—Bursa of Fabricius of day 10 old epinephrine treated chicken. Masson's trichrome. × 1200 Note some parenchymal disorder in the lymph follicle and form some irregular spaces (V).

Fig. 2.—Feulgen stained bursa of (a) noradrenaline and (b) epinephrine treated day 10 old chicken exhibit decreased staining intensity and some pyknotic changes (→). × 1200
control, E and NE treated chickens. No deviation in the level of DNA, RNA, total protein and sialic acid content of treated birds was noticed (Table 1).

Perusal of the results showed that E caused definite changes in the bursa of fabricius of chicken as revealed by the reduction in both the absolute and relative bursa weights (Table 1). However, it is interesting to note that NE treatment fail to reveal such changes.

E caused greater decrease in the cell population of the lymph follicles than NE treated chickens. Similar degenerative changes in the bursa of fabricius of chicken after glucocorticoid administration have also been reported earlier. An interesting point to note was that sialic acid which was believed to have an immunoprotective role, and was reduced by glucocorticoid action, was not at all affected by E and NE treatment. This indicates that catecholamine have some role on bursal morphology, however mechanism of action is still unknown.

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References