CHAPTER VIII

EFFECTS OF INDUCED BLINDNESS ON THE REPRODUCTIVE PHYSIOLOGY OF MALE ALBINO RATS

INTRODUCTION

Various reports reveal that blindness/prolonged darkness/short photoperiods affect the reproductive function of several animals (Wurtman et al., 1968). It is known that blindness leads to atrophy of the sex accessory organs, changes in the metabolism of spermatozoa, regression in the testicular weight and delayed pubescence in rats (Reiter and Johnson, 1974; Reiter, 1975; Reiter et al., 1975; Buch, 1976). The alterations in the morphology and physiology of reproductive organs are manifested only in the initial stages of blindness (Kinson and Chang-Ching Lin, 1974) and are mediated through the pineal which contains anti-gonadotrophic substances (Wurtman et al., 1968; Orts et al., 1974; 1975). The synthesis of melatonin (one of the anti-gonadotrophic principles) from pineal is enhanced in prolonged darkness or by blindness, which in turn influences the gonadal functions (Wurtman et al., 1968; Fraschini et al., 1968, 1971; Yamashita et al., 1973) by affecting the hypothalamus and central nervous system (Quay, 1969; Martini, 1974) and thereby alters the release of gonadotrophins (Frehn et al., 1974; MacPhee, 1975).
An investigation on the effects of induced blindness on the testicular and epididymal physiology of albino rats was undertaken on the basis of the foregoing observations.

MATERIALS AND METHODS

Healthy, adult albino rats (*Rattus norvegicus*) weighing between 200-250 gm were used for the experiments. The animals were maintained on standard feeds (Hindustan Lever Ltd., Bombay) and water *ad libitum* in an air conditioned animal house (26±2°C) with 14 hours day light. They were grouped as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>No. of animals used</th>
<th>Day of autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal intact control</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>Rats with induced blindness for (one month)</td>
<td>12</td>
<td>31st day of operation</td>
</tr>
</tbody>
</table>

**Surgical procedure:**

The animals were anaesthetised with ether and the eye lens was removed by surgery. Care was taken not to injure the blood vessels. After removal of the lens both the eyes were blind folded with surgical tape to prevent the penetration of light. After 30 days of induced blindness the
animals were sacrificed by cervical dislocation. The testis and epididymides were removed, blotted free of blood, weighed and used for the following estimations as detailed in Chapter I.

Ascorbic acid (AA), ascorbigen (ASG), rates of ascorbic acid utilization (AAU) and Ascorbic acid macromolecule complexing (AA-MM) : (Chinoy et al., 1974).

Ascorbic acid free radical (AA-FR) forming special peroxidase: (Chinoy, 1973).

Succinate dehydrogenase (SDH): (Kun and Abood, 1949).

Alkaline and acid phosphatases: (Belfield and Goldberg, 1971).

A minimum of six replicates were done for each tissue and treatment and the results were statistically analyzed using student's 't' test.

RESULTS

Organ weights:

There was an insignificant decrease in the weights of the testis and epididymides.

Table I

Weights (in gm) of the testis and epididymides of the normal control and blind rats

<table>
<thead>
<tr>
<th>Organs</th>
<th>Normal control</th>
<th>Blind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testis</td>
<td>1.38 ± 0.01</td>
<td>1.22 ± 0.04</td>
</tr>
<tr>
<td>Caput</td>
<td>0.20 ± 0.01</td>
<td>0.16 ± 0.03</td>
</tr>
<tr>
<td>Cauda</td>
<td>0.15 ± 0.02</td>
<td>0.12 ± 0.01</td>
</tr>
</tbody>
</table>

Values are mean ± S.E.
Ascorbic acid (AA) and AA-FR special peroxidase:
The levels of free ascorbic acid (AA) increased in epididymides ($P < 0.01$) but was reduced in testis. The rate of utilization increased in all the organs, and significantly ($P < 0.05$) in epididymides. On the other hand, the concentration of ASG increased in testis and caput but was unaltered in cauda. The AA-MM complexing rate increased significantly ($P < 0.05$) in caput and cauda but was undetectable in testis. The AA-FR special peroxidase activity decreased significantly ($P < 0.001$) in all the tissues (Fig. 1).

Succinate dehydrogenase (SDH), alkaline and acid phosphatases:
The concentration of SDH decreased significantly ($P < 0.001$) in all the three organs of blind rats. The alkaline and acid phosphatase activities also decreased in all the organs, except for an increase in acid phosphatase of the testis. However, the decrease was more pronounced ($P < 0.001$) in epididymides than in testis (Fig. 1).

DISCUSSION

A decrease in the androgen dependent enzymes like SDH, AA-FR special peroxidase and phosphatases in the testis and epididymides and a decline in their weights reveal impaired androgenic function of testis during blindness, in conformity with the work of others (Reiter and Johnson, 1974; Reiter, 1975;
Reiter et al., 1975). These effects are known to be mediated by enhanced synthesis of melatonin which is anti-gonadotrophic in nature (Wurtman et al., 1968; Quay, 1969; Martini, 1974; Frehns et al., 1974; Reiter et al., 1975). However, Ellis (1972) has demonstrated a direct inhibitory effect of melatonin and serotonin on testicular steroidogenesis due to inhibition of some of the key enzymes involved in the process. Kinsen and Chang Ching Lin (1974) also reported a decrease in the peripheral plasma levels of testosterone in the early stages of blindness in rats. The increased ascorbic acid storage and the concomitant decrease in AA-FR special peroxidase in all organs of blind rats also suggests a reduction in androgenesis in the testis of these animals.

**SUMMARY**

The changes brought about by induced blindness in the normal functioning of testis and epididymides of rats were studied. The physiology of testis and epididymides was found to be altered due to the reduced testicular androgenicity. The results indicate that the pineal influences reproductive functions.
REFERENCES


2. Chapter I. Synergistic action of testosterone and ascorbic acid for maintenance of epididymal functions.


Fig. 1

The concentrations of free ascorbic acid (AA), ascorbigen (ASG), rates of ascorbic acid utilization (AAU), ascorbic acid macromolecule (AA-MM) complexing, and activities of ascorbic acid free radical (AA-RR) forming special peroxidase, succinate dehydrogenase (SDH), alkaline and acid phosphatases in rats

ND = not detectable
1 = Normal control
2 = Blind rats