Ectopic adrenal tissue in the kidney of rhesus monkeys (Macaca mulatta)

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Summary
The histological appearances of 5 cases are described. The origin, incidence and significance of ectopic adrenals are discussed.

Schmidt (1956) described a small portion of subcapsular ectopic adrenal tissue (1.0 x 0.5 mm) found in a rhesus monkey that had been treated with an antimalarial drug. McClure, Graham & Guilloud (1969) mentioned a similar abnormality in a review of endometriosis in the rhesus monkey.

In man, the condition has been described by Nicholson (1922), Wright (1938), Barnard & Robb-Smith (1945) and Willis (1962). Typically, the ectopic tissue was detected macroscopically as a rounded nodule or flat plaque, varying from just visible up to 20 mm or more in diameter, in or beneath the renal capsule. Microscopically, all 3 cortical zones were present together with a medulla in a few instances. However, in most cases only cortical tissue was present, comprised of cells resembling those encountered in the zona fasciculata or glomerulosa without distinct zones being present (Willis, 1962).

Materials and methods
The present report is concerned with 5 occurrences of ectopic adrenal tissue in the kidneys of wild-caught rhesus monkeys (Macaca mulatta). The animals were obtained from Shamrock Farms (Great Britain) Ltd, Victoria House, Henfield Road, Small Dole, Henfield, Sussex, BN5 9XE, UK, over a period of years, and were allocated to a variety of routine toxicological studies. 4 monkeys were in treated groups and 1 was an untreated control. Table 1 shows the sex distribution and the approximate ages of affected monkeys, together with the relevant macroscopic necropsy details.

The kidneys of monkeys 1, 2, 3 and 4 were fixed in buffered formalin, and sections were made and stained with Harris's haematoxylin and eosin for histological examination. For the 5th monkey, the ectopic tissue was fixed in formol calcium and divided into 2 portions. Frozen sections were prepared from one portion and stained with oil red O, the other portion was processed for electron microscopy by dehydration in alcohol and embedded in epoxy resin.

Received 5 December 1978. Accepted 22 February 1979.

Table 1. Rhesus monkeys in which renal adrenal rests were found

<table>
<thead>
<tr>
<th>Monkey no. and sex</th>
<th>Age (years)</th>
<th>Necropsy findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ♀</td>
<td>3-4</td>
<td>small cortical depression, 1.5 mm diameter</td>
</tr>
<tr>
<td>2 ♂</td>
<td>1-2</td>
<td>numerous petechial haemorrhages on cortical surfaces (a treatment-related effect)</td>
</tr>
<tr>
<td>3 ♀</td>
<td>3-4</td>
<td>small focal capsular adhesions</td>
</tr>
<tr>
<td>4 ♂</td>
<td>3-4</td>
<td>small white subcapsular focus, 1 mm diameter</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 ♀</td>
<td>4-5</td>
<td>small subcapsular depression</td>
</tr>
</tbody>
</table>

Results

Monkey 1. A small unencapsulated circumscribed nodule (about 1 x 1 mm) was present beneath the renal capsule, showing 2 distinct zones (Fig. 1). The cells of the outer (subcapsular) zone were vacuolated and resembled those in the adrenal zona fasciculata. The cells in the inner zone were smaller, with dense eosinophilic cytoplasm, and resembled those in the zona reticularis. The nodule contained at one edge a few cortical tubules.

Fig. 1. Kidney of monkey 1. An unencapsulated subcapsular nodule of adrenal tissue showing 2 zones. Haematoxylin and eosin. Line represents 156 µm.
Monkey 2. A small poorly circumscribed subcapsular nodule (1.0 × 0.5 mm) consisted mainly of large vacuolated fasciculata-type cells (Fig. 2). A few scattered islands of small cells with scant cytoplasm and deeply-staining, round nuclei were noted immediately beneath the renal capsule; these cells resembled normal zona glomerulosa cells. Also, a small number of small compact cells with eosinophilic cytoplasm were present between the fasciculata-type cells and the renal tissue. They were probably reticularis-type cells.

Monkey 3. A small, poorly circumscribed subcapsular nodule (1.0 × 0.3 mm) which consisted of compact cells with eosinophilic cytoplasm (zona reticularis type). A single nest of glomerulosa-type cells was present.

Monkey 4. A circumscribed subcapsular nodule (3.0 × 1.5 mm) was present with distinct areas of large vacuolated fasciculata-type cells and compact reticularis-type cells. Several scattered renal tubules were present in the nodule.

Monkey 5. In sections stained with oil red O a circumscribed subcapsular nodule (1.5 × 0.5 mm) showed 3 distinct zones: a narrow outer zone (subcapsular) of glomerulosa-type cells, a broad middle zone of fasciculata-type cells containing numerous lipid droplets, and a narrow inner zone of reticularis-type cells. At electron-microscope examination, the preservation was adequate to distinguish these zones. Glomerulosa-type cells contained few mitochondria and occasional lipid droplets. The fasciculata-type cells contained numerous large mitochondria and lipid droplets of varying sizes (Fig. 3). The reticularis-type cells had large mitochondria, abundant endoplasmic reticulum, a few small lipid droplets and numerous lysosomes of varying sizes.

Discussion

The occurrence of ectopic adrenal tissue in the kidneys of monkeys was considered to be spontaneous and unrelated to any form of treatment. With the close proximity of adrenal and renal primordia in the embryo, the inclusion of a small portion of adrenal tissue within the adjacent renal capsule is understandable (Willis, 1962). The picture found in rhesus monkeys was essentially similar to that found in man except that adrenal medullary cells were not evident in the 5 monkeys examined. The light and electron microscope results indicated that the ectopic tissues were functionally active.

The prevalence of renal ectopic adrenal tissue at this Centre was about 1 in every 600 rhesus monkeys examined. As the majority of these abnormalities were
Adrenal tissue in monkey kidneys noted at post-mortem examination and subsequently confirmed at histological examination, it is probable that this figure was reasonably accurate. However, small sub-macroscopic abnormalities may have been present and remained undetected.

The existence of functional ectopic adrenal tissue in rhesus kidneys could have significance in the field of experimental surgery. They might also be important in differential diagnosis, where they could mimic small tubular epithelial-cell proliferations.

Acknowledgements
I wish to thank R. J. Sortwell for provision of clinical details of the monkeys, and Margaret Hughes for preparing the typescript.

References


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Zusammenfassung