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Note on rhinoceros thyroid gland constitution

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(With 2 figures in the text)

In the absence of direct embryological information an estimation of rhinoceros thyroid gland constitution is essayed on the basis of indirect evidence provided by a study of 22 rhinoceros thyroid lobes, representing all available rhinoceros species. It is concluded that the rhinoceros thyroid gland comprises two embryonal elements, deriving from the thyro-glossal duct and from the 4th pharyngeal pouch, responsible respectively for its ventral and dorsal portions.

Introduction

The embryological development of the rhinoceros thyroid gland is presently unknown from investigation of its ontogeny in any rhinoceros form, a situation likely to remain long unchanged. Consideration is therefore given to certain indirect evidence potentially informative of the embryological composition of this gland. Such evidence derives from the details of rhinoceros thyroid gland anatomy, principally the configuration of the gland and its relationship with the parathyroid gland. Conclusions based thereon necessarily remain tentative and subject to modification in the light of future embryological findings, but are nevertheless of some interim value.

Evaluation of this indirect morphological evidence is based upon two *a priori* postulates—first, that the rhinoceros thyroid gland is not necessarily restricted to a single embryonal source of origin, second, that the single parathyroid gland invariably associated with the thyroid lobe is the conventional parathyroid IV of mammalian embryology. Considerations of comparative anatomy render both these postulates reasonable. Their acceptance implies, therefore, the development of the rhinoceros thyroid gland from at least two formative elements, namely (1) a median element (thyro-glossal duct) and (2) a lateral element (embryonal 4th pharyngeal pouch). Such a concept of rhinoceros gland constitution is consistent with, and explanatory of, the morphological data as is no alternative concept.

In this present analysis of rhinoceros thyroid gland constitution on a basis of indirect morphological evidence, the data utilized are provided by a series of 22 thyroid lobes, comprising 12 lobes of the Indian rhinoceros (*Rhinoceros unicornis*), 4 of the Sumatran rhinoceros (*Didermocerus sumatrensis*), 4 of the African White rhinoceros (*Ceratotherium simum*) and 2 of the African Black rhinoceros (*Diceros bicornis*).

Observations

Thyroid gland configuration

Within its traditional "thyroid" or "shield" shape the rhinoceros thyroid gland manifests considerable variation in the configuration of its lateral lobes, marked differences obtaining

between the lobes of different glands and even between the two lobes of the same gland. Most commonly, however, the lobe presents as a pyriform mass, tapering from a thick, broad, blunt cranial extremity to a thinner, narrower and irregularly-shaped caudal extremity. Over 80% of lobes in the present series conform to this shape: in some 60% of lobes the topographical subdivision into larger cranial and smaller caudal moieties is emphasized by an intervening constriction or "waist", reinforced in some lobes by a deep fissure penetrating the lobe from its ventral margin. This obtrusive cranio-caudal modelling of the thyroid lobe is a strictly anatomical feature of the gland, impossible of correlation with any recognizable embryological factor and nothing more than the effect of extrinsic mechanical factors upon the extremely soft, highly vascular thyroid parenchyma. (In this connexion the thyroid lobe is reminiscent of the highly vascular spleen.)

Significantly the caudal extremity of the rhinoceros thyroid lobe is always continuous with any isthmus present. Since the isthmus derives unquestionably from the primitive pharyngeal median thyroid downgrowth (thyro-glossal duct) its presence and its continuity with the thyroid lateral lobe establishes unequivocally the origin from this median embryonal element of part at least of the rhinoceros thyroid gland. In the present series of 22 lobes the isthmus is invariably continuous with the ventral part of the caudal pole and with the ventral part of the lobe mass itself. An isthmus is retained—from the metamorphosis of thyro-glossal duct tissue—in some 60% of the 22 lobes, being constant (2 mm) in thickness but varying (from 3 to 13 mm) in width. No pyramidal lobe occurs in the series nor does any cystic formation along the track taken by the thyro-glossal duct.

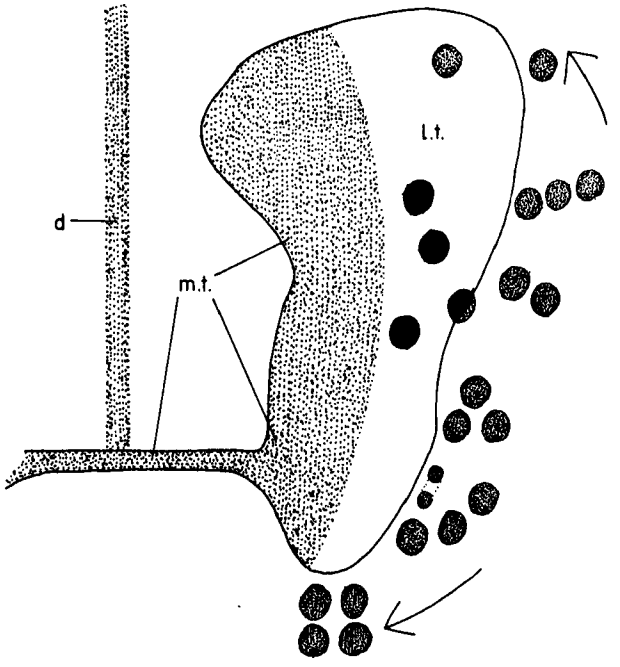

FIG. 1. Rhinoceros thyroid gland. Diagram showing (persistent) thyro-glossal duct, isthmus and lateral lobe to indicate morphological composition of organ and relationship thereto of parathyroid gland in 22 specimens.

d=thyro-glossal duct: lt=lateral thyroid (pouch IV) element: mt=median thyroid element (stippled). Intra-thyroidal parathyroids black, juxta-thyroidal parathyroids stippled.

Parathyroid gland relationship

The canonical complement of rhinoceros parathyroid glands is two, one to each thyorid lateral lobe, an arrangement constant throughout the present lobe series and valid for each rhinoceros species represented therein. On comparative anatomical grounds this single rhinoceros parathyroid is to be interpreted as parathyroid IV of conventional embryological notation, that is, as a derivative of the 4th pharyngeal pouch. (In one lobe only of the series is a parathyroid III present, a supernumerary body situated well caudad of the caudal pole.)

In all lobes of the series a constant, consistently close relationship obtains between the parathyroid gland and the homolateral thyroid lobe. The parathyroid is invariably and exclusively related to the dorsum of the lobe, lying anywhere along its border from the cranial to the caudal pole or therefrom invading a parallel district of lobe parenchyma (Fig. 1). In the present series of 22 lobes the parathyroid gland is juxta-thyroidal in 17 (about 80%), epi-thyroidal in 2 (about 8%) and intra-thyroidal in 3 (about 12%). It is significant that when intra-thyroidal in position, the parathyroid remains within the dorsal moiety of the thyroid lobe and never invades the ventral moiety. This constant and intimate association of parathyroid gland (parathyroid IV) with the dorsal portion only of the thyroid lobe indicates forcefully a common source of origin, namely, the 4th pharyngeal pouch.

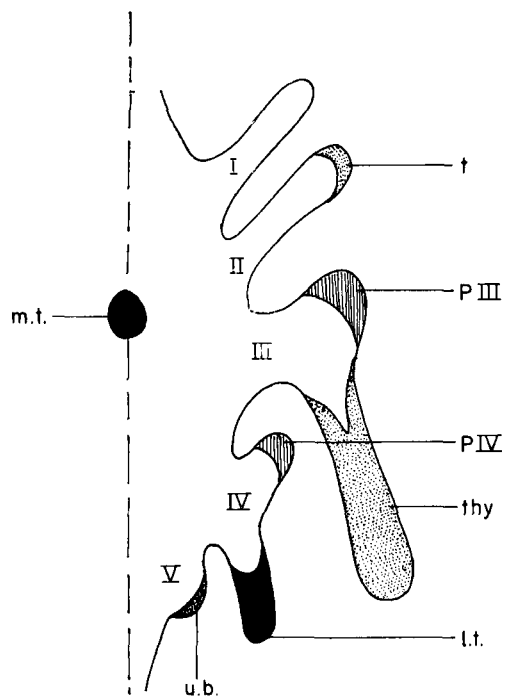

FIG. 2. Diagram of dextral moiety of mammalian embryo pharynx to indicate pharyngeal pouches I to V and their derivatives.

lt=lateral thyroid rudiment; mt=median thyroid rudiment (thyro-glossal duct): P III, P IV=parathyroids III and IV: t=tonsil: thy=thymus: u.b.=ultimo-branchial body. Thyroid rudiments black.

Commentary

That the rhinoceros thyroid gland develops in part from a median (thyro-glossal embryonal element is established by its manifestation, temporary or permanent, of an isthmus: that it develops in other part from a lateral (pharyngeal pouch) embryonal element is virtually attested by its constant and intimate association with a parathyroid gland.

The median embryonal element would appear to give rise to a ventral moiety of the gland comprising the isthmus and the ventral portion of the lateral lobe, a parenchymal territory invariably and conspicuously unassociated with any parathyroid formation. The lateral embryonal element would appear to give rise to the dorsal moiety of the lateral lobe, a parenchymal territory invariably associated with a parathyroid gland.

Since the canonically single rhinoceros parathyroid is undoubtedly the mammalian parathyroid IV the inference is inescapable that the associated dorsal moiety of the thyroid lobe is of corresponding developmental origin, that is from the 4th pharyngeal pouch (Fig. 2).

(For convenience the ventral and dorsal components of the rhinoceros thyroid gland are herein termed moieties: whether these components are of equal size and whether they share equally in the constitution of the gland cannot, however, be determined by any strictly anatomical criterion.)

Clearly the topographical configuration and the embryological constitution of the rhinoceros thyroid gland are not only unrelated but fundamentally dissimilar, the essential morphological division of the lobe being not cranio-caudal but ventro-dorsal.

Assessment therefore of the total morphology of the thyroid gland in any rhinoceros species compels the conclusion that this organ is of dual embryonal origin and comprises a ventral portion developing from a median (thyro-glossal duct) element and a dorsal portion developing from a lateral (4th pharyngeal pouch) element. This interpretation of rhinoceros thyroid gland constitution awaits validation by direct embryological investigation but in the interim provides an acceptable working hypothesis.