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Anatomy of the Porcine Thyroid

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SUMMARY

Tissues ventral to the porcine thyroid were dissected to establish the relationship of these structures to the thyroid gland. Arterial supply and venous drainage of the thyroid gland were also determined.

Dissected thyroid glands of swine were located in the peritracheal fascia ventral to the trachea. Longitudinal position of the gland varied from the caudal ventral border of the larynx to a position dorsal to the manubrium sterni. The average thyroid gland weight of 23 swine, representing different breeds and sexes, was 4.93 gm. per 100 pounds of body weight.

Injected iodine I^{131} was found to concentrate in the thyroid gland of swine with little I^{131} uptake by other body organs.

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INTRODUCTION

Swine are gaining importance as experimental animals in fundamental studies as a result of the recognition of the many similarities between their physiological systems and those of man. The gastro-intestinal tract is provided with a simple stomach very similar to that of man. The ability of swine to store fat has been compared with adipose depots in man and cardio-vascular conditions such as atherosclerosis are now being studied in aging swine. A more complete evaluation of the anatomical and biological characteristics of swine would be useful in order to establish a more standardized physiological description of this species.

The present study of the anatomy of the thyroid gland of swine was initiated to describe, more completely, individual variations in the anatomical structure of this gland and to use these findings in the development of a procedure for determining daily thyroxine secretion rate of swine (see Romack, 1963).

METHODS AND MATERIALS

To determine, initially, the anatomical location of the procine thyroid gland and its associated anatomical structures, an animal was embalmed and topographically dissected to reveal the detail in structural arrangement in the area of the thyroid gland. Observations were then made on additional cadavers and on carcasses of slaughter animals to describe individual variations in location and size of the porcine thyroid.

To determine the functional level of accessory thyroid tissue existing in swine and to determine the level of uptake in various body tissues, an animal was injected with 200 microcuries of I^{131} and allowed a three day period for maximal uptake and accumulation of I^{131}. The animal was sacrificed and a search was made for I^{131} throughout the body tissues by using a radiation count-rate-meter with lead shielding on the probe crystal to eliminate extra-radiation counting.

RESULTS AND DISCUSSION

To expose the thyroid gland, a mid-ventral incision was made through the skin and subcutaneous adipose tissue. Reflection of this tissue revealed the muscles ventral to the thyroid gland. These are the superficial cutaneous colli muscle fibers, the right and left sternocephalicus muscles and the right and left sternohyoideus muscle. Tissues from the parotid salivary gland were found in this area in some specimens (Figures 1, 2 and 3). The position of the thyroid varied among individuals. In some animals, the cranial extremity of the thyroid was resting on the caudal border of the larynx, while in others the thyroid was positioned caudally to the extent that it was located dorsal to the manubrium sterni. Similarly, Sisson and Grossman (1953) reported that the thyroid of swine is usually some distance from the larynx, but it may also be found in contact with the caudal extremity of the larynx.

Arterial blood supply and venous drainage from the thyroid gland are shown in Figure 3. The primary arterial supply approaches the dorsal surface of the right caudal border of the thyroid gland as the thyroid artery. The thyroid artery arises from the right omocervical artery (inferior cervical). In some speci-

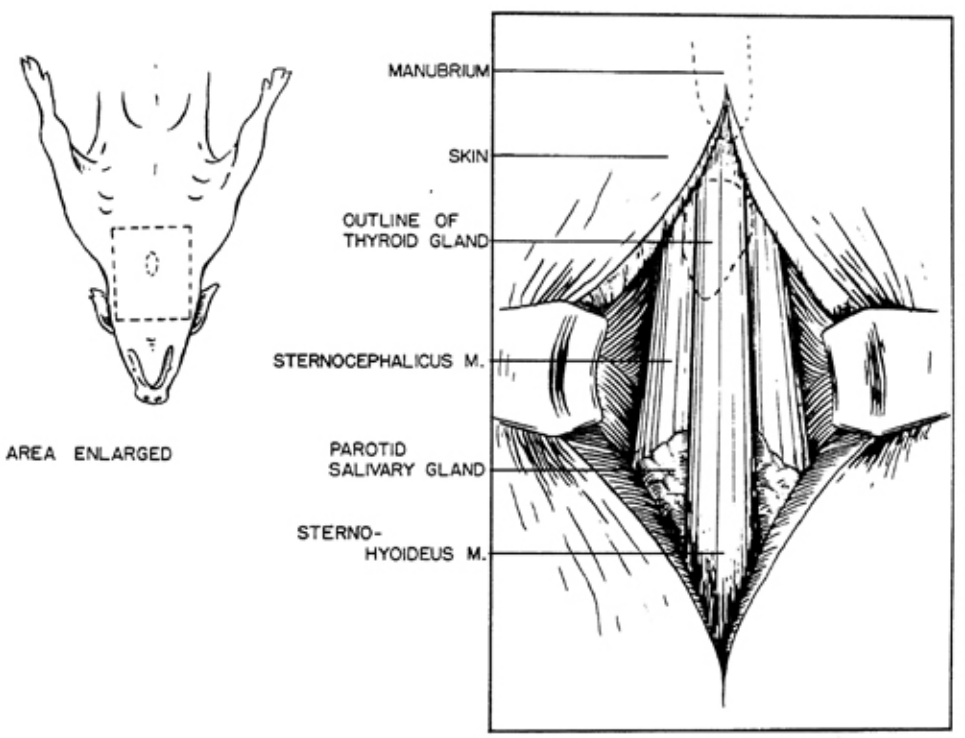

Fig. 1—Schematic drawing of the tissues ventral to the thyroid gland.

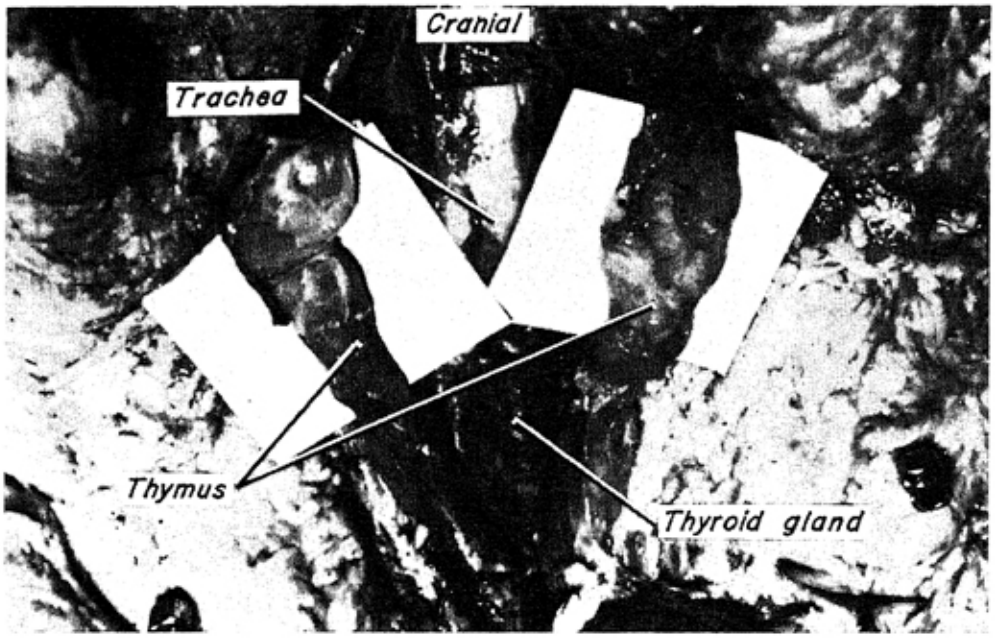

Fig. 2—Dissection of the tissues ventral to the thyroid gland.

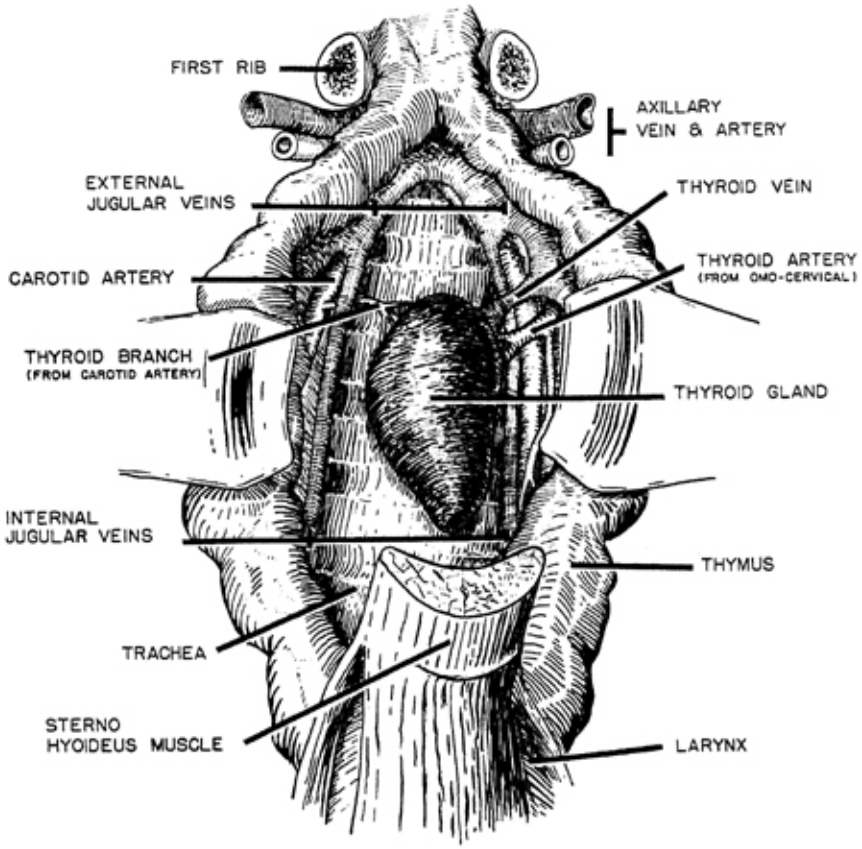

Fig. 3—Schematic drawing of the tissues and anatomical structures in relation to the thyroid gland (ventral view).

mens a second thyroid arterial branch supplied the dorsal surface of the thyroid gland on the left caudal border. This arterial branch, when present (observed in less than 25 percent of the observations), arises from the left common carotid artery. Some arterial blood is supplied to the thyroid through capillaries and arterioles located along the lateral, dorsal, and cranial borders of the gland which anastomose with the arteries located in the peritracheal fascia. Sisson and Grossman (1953) state that the posterior thyroid artery arises from the ascending branch of the inferior cervical artery.

Two thyroid veins were present in all animals studied. The right vein leaves the posterior extremity of the gland and courses caudally and laterally, emptying into the right external jugular vein near its juncture with the right internal jugular vein. The left thyroid vein was about one-third as large as the right and showed an occasional anastomosis with a branch of the laryngeal veins. The normal pathway of the left thyroid vein and its termination was similar to that of the right vein. Similar findings have been reported by Caylor and Schlotthauer (1927) and St. Clair (1958).

The porcine thyroid gland is a bilobed gland connected by a very large isthmus. It appears, on casual observation, as a single gland as shown in Figure 5.

Thyroid glands were dissected from 23 adult animals to determine average gland weight. Data are presented in Table 1 for Poland China boars and Duroc and Hampshire sows. The average gland weight for both sexes was 4.93 gm. per 100 pounds of live weight.

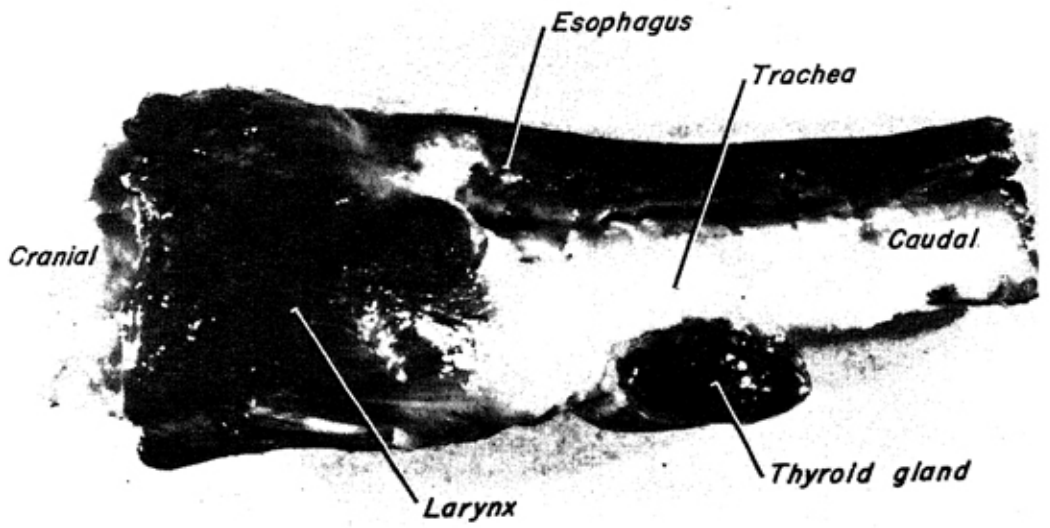

Fig. 4—The relationship of the porcine thyroid gland to the larynx, trachea, and esophagus (lateral view).

TABLE 1 - THYROID GLAND WEIGHTS OF 23 ADULT SWINE

Breed & Sex	Number	Body Weight	Thyroid Gland Wt.	Grams Per 100 Lbs. Body Wt.
Poland Boars	B-105	420	22.90 gm.	5.45
	B- 38	376	23.50 gm.	6.25
	B-226	327	26.32 gm.	8.05
	B-179	335	23.50 gm.	7.01
	B- 12	295	14.40 gm.	4.88
	B-185	362	11.30 gm.	3.12
	B- 33	275	21.80 gm.	7.93
	B-143	258	19.40 gm.	7.52
Average		331	20.39 gm.	6.28
Duroc Sows	S-114	402	19.30 gm.	4.80
	S-251	372	16.77 gm.	4.51
	S- 22	357	17.04 gm.	4.77
	S-232	304	13.33 gm.	4.38
	S- 54	370	14.00 gm.	3.78
	S-332	285	10.32 gm.	3.62
	S- 31	331	11.03 gm.	3.33
	S- 24	397	12.00 gm.	3.02
	S-238	252	8.45 gm.	3.35
Average		341	13.58 gm.	3.95
Hampshire Sows	S-243	278	14.53 gm.	5.23
	S-103	320	16.90 gm.	5.60
	S-227	267	8.33 gm.	3.12
	S-222	311	11.90 gm.	3.83
	S-295	294	8.35 gm.	2.84
	S-162	238	16.92 gm.	7.11
Average		282	12.82 gm.	4.62
Average All Animals		322	15.75 gm.	4.93

The Poland China boars that were studied had an average body weight of 331 pounds and an average thyroid weight of 6.28 gm. per 100 pounds of body weight. This was somewhat higher than that found in Hampshire sows weighing an average of 282 pounds; their average gland weight was 4.62 gm. per 100 pounds of live weight. These gland weights were somewhat higher than those indicated by Baird *et al.* (1952) who reported an average thyroid weight of 3.16 gm. per 100 pounds of live weight for a rapid-growing strain of pigs.

Table 2 summarizes the results obtained from an animal that had been injected with I^{131} three days prior to sacrifice. A background reading of 1.5 counts per second was measured which has to be considered in evaluating all values given in Table 2. Small amounts of radioactivity were present in the thymus, spleen, pancreas, gall bladder, heart and adrenal gland. Slightly higher residues were recorded for the liver, colon, blood, kidney, and lung. Bustad (1961) re-

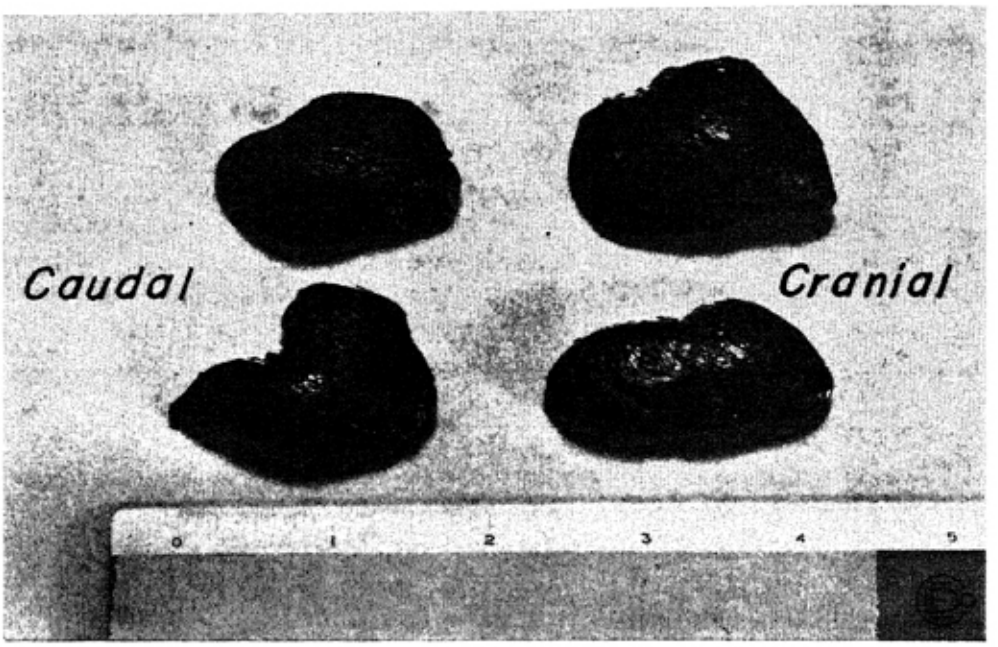

Fig. 5—Four porcine thyroid glands demonstrating variation found in shape of the gland (ventral aspect.)

TABLE 2 - RADIO-ACTIVITY OF DISSECTED TISSUES AND ORGANS OF A GROWING PIG INJECTED WITH I^{131}

Tissue	Radio-Activity, Counts/Sec.
Mandibular lymph node	1.5
Mandibular salivary gland	1.5
Thymus	1.8
Liver	2.5
Spleen	1.6
Pancreas	1.6
Gall Bladder	1.7
Stomach	1.5
Duodenum	1.5
Colon	2.0
Blood	2.0
Heart, R. Auricle	1.8
Heart, R. Ventricular muscle	1.8
Abdominal lymph node	1.5
Adrenal gland	1.8
Kidney	2.0
Lung	2.5
Lumbosacral area (body mass)	10.0
Cervicothoracic area (body mass)	20.0
Thyroid gland	1250.0
Background Radiation	1.5

ported that the greatest loss of I^{131} from swine was through urine excretion. As was expected, a high concentration of I^{131} was found in the thyroid gland.

Body mass recordings were made after the tissues and organs listed in Table 2 were removed from the carcass. The higher reading in the cervico thoracic area than in the lumbosacral area was believed to be due to the larger residual blood volume present in the former area or perhaps the presence of small amounts of accessory thyroid tissue in this area. However, accessory thyroid tissue was not detected in any of the dissected cadavers or slaughter animals in spite of careful and detailed searching. It has been observed in a separate study (unpublished data) that surgical removal of porcine thyroid glands will, within two months time, result in the proliferation of accessory thyroid and/or mesenchymal cells to the extent that many grotesque growths of thyroid tissue may be found by dissection or as indicated by the uptake of I^{131}. These structures contain well-developed follicular structures with normal stores of thyroglobulin and may be found in the peritracheal fascia from the level of the larynx caudally as far as the thoracic inlet. Recent work by Schmidt *et al.* (1964) indicates that accessory thyroid tissue proliferates to a substantial extent within 35 days.

The presence of accessory thyroid tissue in the pig has also been reported by Caylor and Schlotthauer (1927) who observed as many as six accessory glands in one animal. These are described as small pink bodies, one to three centimeters in diameter and usually situated in loose connective tissue on the trachea near the thyroid gland or they may be found in any situation in the neck or in the thoracic cavity. Accessory thyroid tissue has been reported in the human by Rodger and Kesten (1962) and in the dog by Geil (1961).

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