SURGICAL MANAGEMENT OF HYPERPARATHYROIDISM

An essay submitted in partial fulfillment of master degree

of

general surgery

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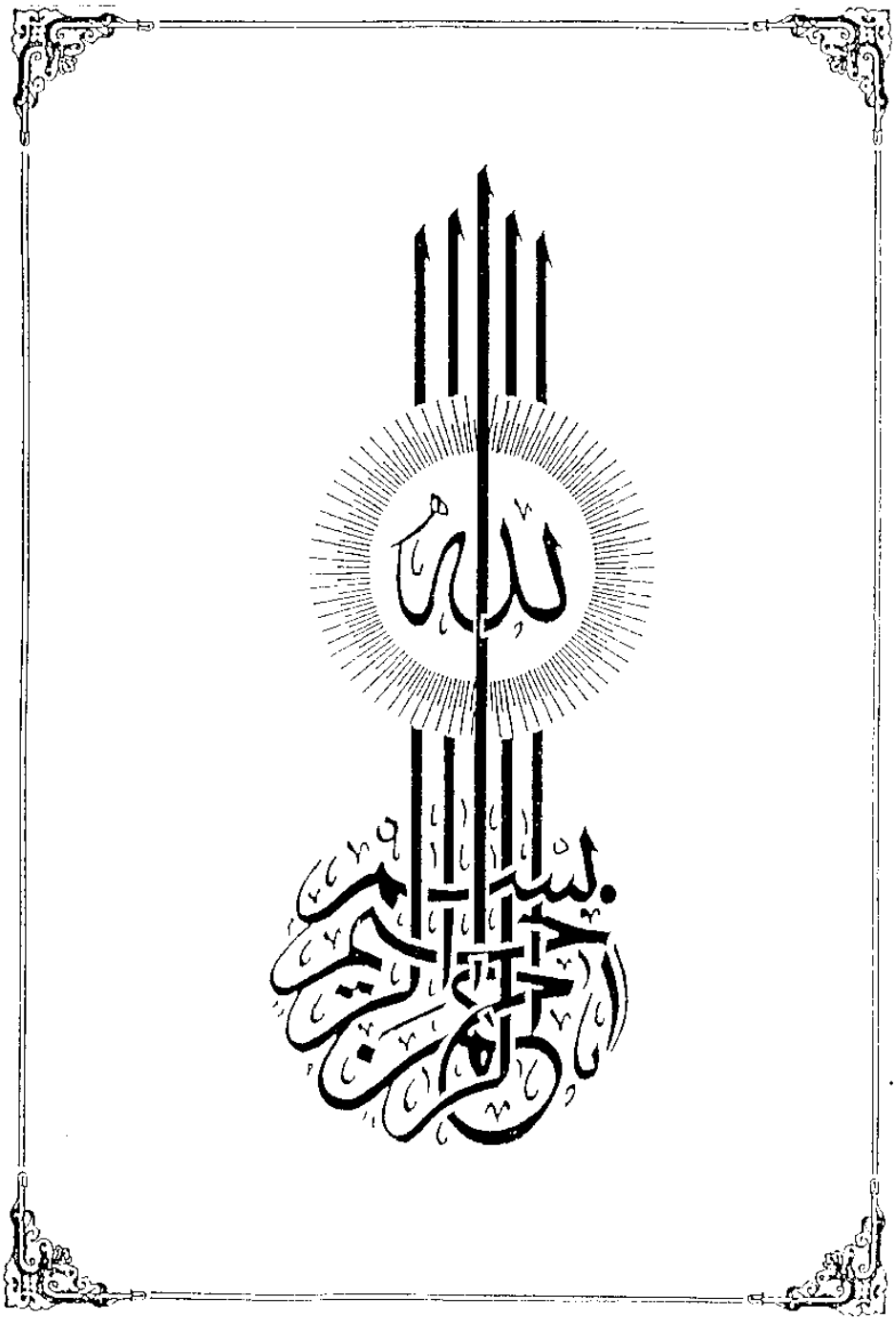

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Abbreviations:-

HPT = Hyperparathyroidism .

PTH = Parathyroid hormone .

MEN = Multiple endocrine neoplasia.

Introduction

INTRODUCTION

In 1880, a Swedish student, Ivar Sandstrom, first described the parathyroid glands in several animals including man and named the parathyroid glands (glandulae parathyroidae).
The name was well chosen, as "para" is the Greek prefix meaning alongside of *(Petti, 1990)*.

The first parathyroid exploration in the United States was performed in 1926 at the Massachusetts General Hospital on a merchant marine with severe bone disease. The first successful parathyroidectomy was performed in 1929 by Barr,Bulger,and Dixon, they proposed the term hyperparathyroidism *(Wells et al., 1991)*.

Biologically active parathyroid extracts were first prepared by Collip in 1925. Parathyroid hormone was isolated and purified by Rasmussen, Craig and Auerbach in 1959. In 1963, Berson and associates developed a radioimmunoassay for parathyroid hormone *(Wells et al., 1991)*.

The main function of the parathyroid glands is to maintain calcium and phosphorus homeostasis. For the homeostatic mechanism to function well, a permissive level of vitamin D is necessary *(Petti, 1990)*.

The disorders of parathyroid functions are either increased function " hyperparathyroidism " most of which need surgical intervention or decreased function " hypoparathyroidism " *(Wells et al., 1991)*.

Ectopic hyperparathyroidism in which non parathyroid neoplasm may produce parathyroid hormone or parathyroid hormone like peptides causing hypercalcemia is an added entity which needs proper diagnosis and surgical intervention *(Benson et al., 1974)*.

A knowledge of the normal anatomy and appearance of the parathyroid glands is of paramount importance to the operating surgeon *(Friedman et al., 1986)*.

For successful surgical exploration the normal and abnormal locations of the parathyroid glands should be understood. Numerous techniques have been utilized to localize hyper-functioning parathyroid tissue preoperatively, noninvasive tests as radionuclide scan(thallium-201,technetium-99m,pertechnetate). Ultrasound, computed tomography and magnetic resonance imaging. The invasive tests are arteriography and venography with selective venous catheterization of parathormone*(Petti, 1990)*.

Surgery on parathyroid glands may be complicated by hypocalcemia which may be temporary or permanent (tetany) in 20% - 30%, vocal cord paralysis in 1% or less and persistent or recurrent hypercalcemia due to missed parathyroid adenoma which adds to the morbidity *(Petti, 1990)*.

The aim of this study is the evaluation of the subject of parathyroid surgery in hyperparathyroidism patients, including important anatomical facts, clinical variations and new methods of investigations to minimize post-operative complications, and their manegement.

Anatomy of Parathyroid Glands

ANATOMY OF PARATHYROID GLANDS

EMBRYOLOGY

During the fifth week of gestation, the parathyroid glands derived from the ectoderm of the dorsal third and fourth branchial pouches. The third arch also forms the thymus glands. In its descent, the parathyroid is brought along and comes to lie near the lower portion of the thyroid gland. The fourth arch, parathyroid does not migrate, so it becomes the upper gland *(Keyes and Tenta, 1980)*.Fig.1

Aberrant parathyroid from the third and fourth arches occurs in 15 - 20% of cases. With Knowledge of the derivatives of these arches,the surgeon can be assisted in finding the ectopic gland. Surgeons have found hyperfunctioning glands as high as the internal carotid artery and as low as the aortopulmonary window anterior or posterior to aortic arch.

Table (1) Aberrant Sites for Parathyroid Adenomas:

- Anterior mediastinum.	- Thymus. - 3rd arch.
- Posterior mediastinum.	- 4th arch.
- Aortic pulmonary window.	- Middle mediastinum.
- Retro-oesophageal.	- Prevertebral.
- Tracheoesophageal.	
- Intrathyroidal.	
- Carotid bifurcation.	

(After Petti , 1990).

During embryogenesis, the upper and lower parathyroids lie in close proximity to the thyroid and thymus glands, but as foetal maturation progresses, separation of adjacent structures occur. The upper parathyroid glands may not be completely

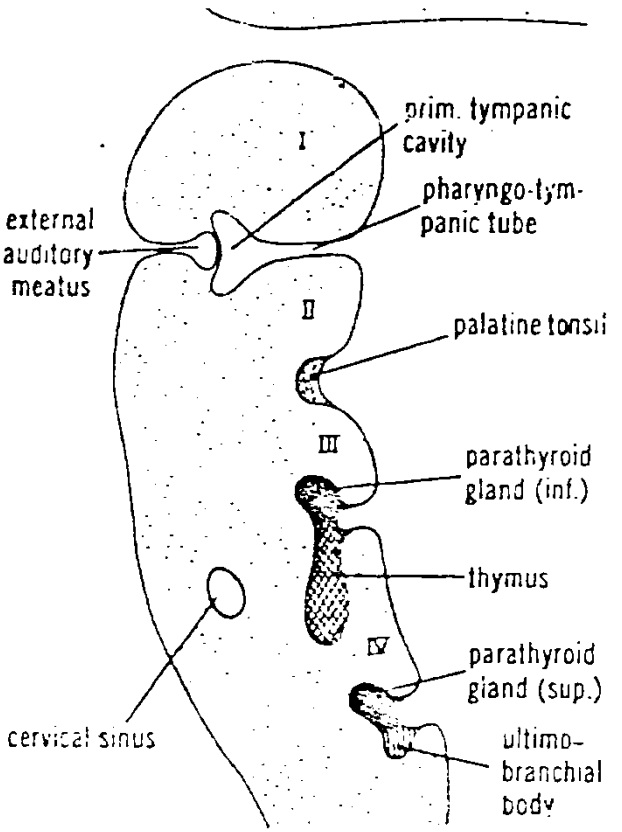

Fig.1.Schematic representation of the development of the pharyngeal pouches. The inferior parathyroid arises from the third pouch in conjunction with the thymus; the superior arises from the fourth in conjunction with the developing thyroid or ultimobranchial body (After Wells et al., 1991).

separated from the thyroid. Anomalies in the migration of lower parathyroid glands, are more common than upper glands *(Samuel et al., 1980)*.

Because the inferior glands travel so far in embryologic life, they have a very wide range of distribution in the adult. They may be found all the way from just beneath the mandible to the pericardium *(Smith and Paloyan, 1992)*.

MACROSCOPIC ANATOMY

In adult, there are 4 parathyroid glands *(Boyle & Gallacher, 1993)*.

Wang. (1976) noted that, in 160 autopsies an incidence of 1.9% had five parathyroid glands and an incidence of 0.6% of patients had six glands. 156 patients had four glands. Those in whom less than four glands were identified were excluded .

Akerstrom and Associates. (1984), performed autopsy studies on 503 cadavers and found parathyroid glands in all but 18 (3%) having three glands could be identified. In 421 (84%) of cases, there were four parathyroid glands however, more than (4) glands were detected in 64 cases (13%). Most often the supernumerary gland was located in thymus.

The presence of as many as eight parathyroid glands has been documented, but patients with fewer than three or more than five are very uncommon *(Ricardo et al., 1985)*.

The clinical significance of such supernumerary glands lies

in the fact that it can be the cause of recurrent or persistent hyperparathyroidism *(Wang, 1976)*.

The parathyroid glands lie characteristically behind the lateral lobe of thyroid gland, usually outside but sometimes within the capsule of pretracheal fascia *(Mcminn, 1990)*.Fig.2

POSITION OF THE UPPER PARATHYROID GLANDS

In a study done by*Wang. (1976)*,in a great majority of cases, about 77% of upper parathyroids were found in close proximity to the dorsum of the upper part of thyroid to be at the cricothyroid junction posterioly. Here the gland was intimately associated with and occasionally hidden by the recurrent laryngeal nerve and the adjacent vascular branches. Most of these glands were suspended by small pedicle and involved by a pad of fatty tissue. About 22% of parathyroids were tucked behind the upper pole of the thyroid. In this position the parathyroids were subcapsular, lying underneath the surgical capsule of the thyroid.
1% of parathyroids were uncovered behind the lower pharyngeal and upper oesophageal junction in midline.

The position of the glands on one side was symmetric with that on the other side in approximately 80% of patients.
The superior parathyroid glands were most frequently found about the intersection between the laryngeal nerve and the inferior thyroid artery *(Ricardo et al., 1985)*.

Also *Akerstrom et al. (1984)*, found that the superior parathyroid glands in about 80% of patients were located within

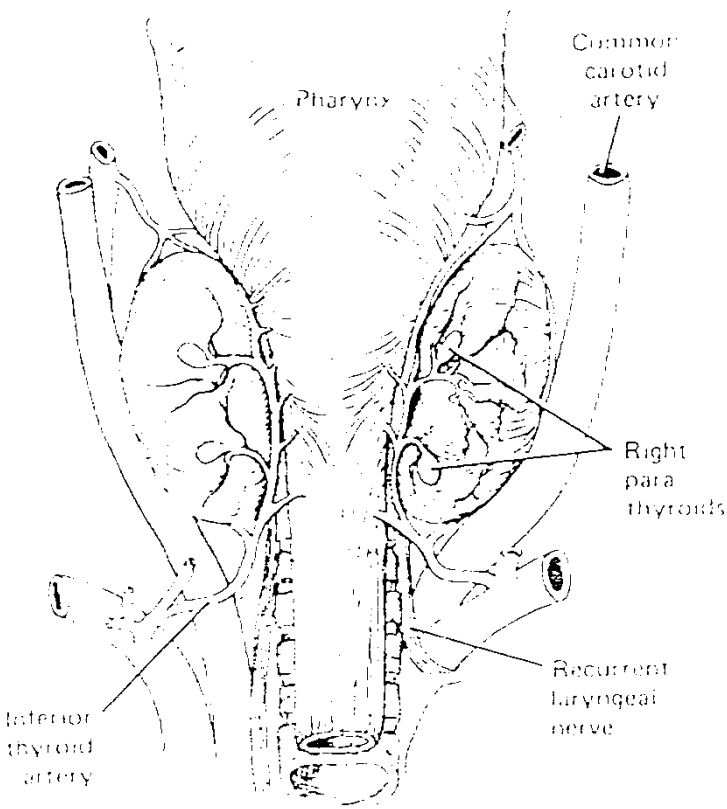

Fig. 2. The human parathyroid glands, viewed from behind. (After Ganong, 1989).

a circumscribed area of 2 cm in diameter about 1 cm above the intersection of the recurrent laryngeal nerve and the inferior thyroid artery.

POSITION OF THE LOWER PARATHYROID GLANDS

The commonest location of inferior parathyroid glands lay somewhat more ventrally than the superior glands, close to the lower thyroid pole or in the upper thymus. Inferior parathyroid glands which lie more than 2 cm below lower pole of the thyroid are associated universally with thymic tissue.Rarely parathyroid glands were located in the pericardium *(Ricardo et al.,1985)*.

Akerstrom et al. (1984), found in 0.2% of the patients, the parathyroid glands lying totally within the thyroid gland. Akerstrom found that the commonest sites of the inferior parathyroids were inferior, posterior or lateral to the thyroid pole . In 17 % of patients, the lower glands were found anterioly high up on the thyroid lobe closely attached to the thyroid capsule. In 26 % the inferior parathyroid glands were closely associated with the superior thymus.
The inferior glands which lie over the thymus or below it in the anterior mediastinum were rare. Fig.3

SIZE, WEIGHT, COLOUR,CONSISTENCY AND SHAPE OF PARATHYROID GLANDS

The parathyroid glands are in the size of a split pea. The normal gland tends to be flat and ovoid but on enlargement they become globular. Normally, they measure 5 - 7 mm, X 3 - 4 mm, X 0.5 - 2 mm . *(Wells et al., 1991)*.

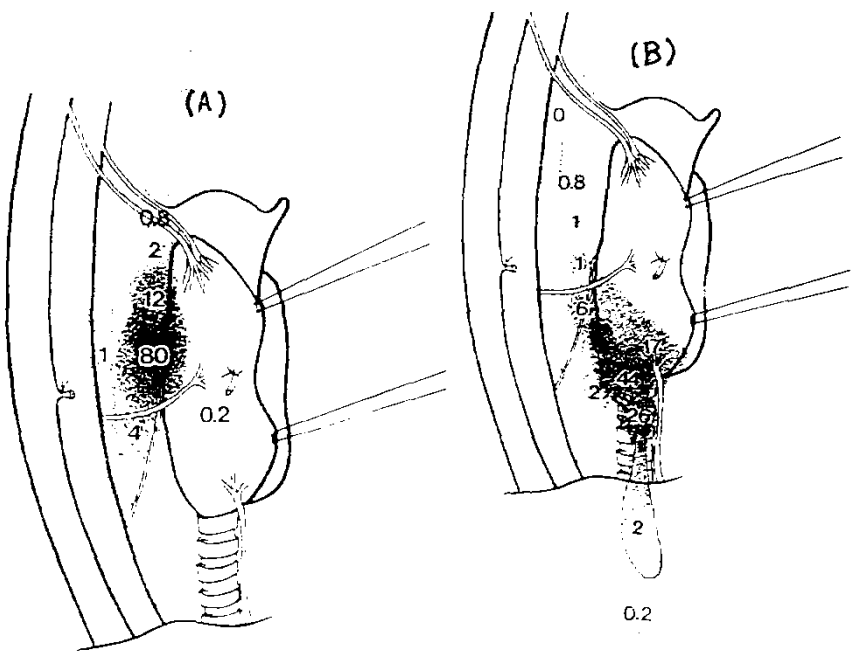

Fig.3.Locations of the superior(A)and infrior(B)parathyroid glands. The more common locations are indicated by the darker shading. The numbers represent the percentages of glands found at the different locations.(After Akerstrom et al., 1984).