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The Incidence of Pineal calcification in the adult Singapore Population

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Synopsis:

The incidence of pineal calcification is appreciably lower in the adult community of Singapore when compared with similar groups in the Western population. It is found to range from approximately 20 per cent in the 20–29 age-group to 40 per cent in the 60 and over age-group with a weighted mean incidence of 30 per cent. The low frequency of pineal calcification is well known among local radiologists but it seems to have escaped formal investigation. The low incidence poses a handicap as radiologists are more often deprived of a simple and valuable means of detecting brain shift.

Introduction:

The pineal body which philosophers like Descartes thought to be the seat of the soul, is a cone-shaped organ, about 7 by 5 mm in size. It is located within the brain being attached to the diencephalon by the pineal stalk. It has now been established that the pineal is really not part of the brain and receives its sole neuronal input from the peripheral autonomic system.

While in lower vertebrates, the pineal serves as a neurosensory photoreceptive organ with a function akin to that of the retina of the eye, it is a secretory gland in mammals. It contains a group of active substances related to indole, the so-called "indole hormones", which include melatonin and serotonin.

Recent researches have shown that the receptors sensitive to the pineal hormones are localised almost exclusively in the brain. Published evidence for a nervous site of action of these hormones include: (a) studies indicating that exogenous melatonin is concentrated by nervous structures (Anton-Tay and Wurtman, 1969); (b) the observation that melatonin may modify some biochemical processes in the brain, such as the metabolism of serotonin (Anton-Tay et al, 1968); and (c) the data that brain implants of melatonin, but not intrapituitary ones, may reduce gonadotrophin secretion (Fraschini, Mess and Martini, 1968). The importance of the pineal gland in human physiology has yet to be assessed.

Of radiological importance is the fact that after puberty granules of calcium and magnesium salts appear in the gland (Barr, 1972). These calcareous granules coalesce later to form large particles so that the organ may become visible on plain x-ray films. The frequency of visualisation of the pineal increases with advancing age.

Dyke (1930) in a study of 3,000 consecutive skull radiographs found the pineal body visible in about 60 per cent of American adults. Vastine and Kinney (1927) noted pineal calcification in approximately 55 per cent of American subjects above the age of 20. More recently, British authors, du Boulay and O'Connell (1969) estimated that calcification occurs in some part of the pineal organ in 50 to 70 per cent of all adults.

The calcified pineal body serves as an excellent midline indicator. It is centrally situated, lying under the falx cerebri and is readily susceptible to shift by a space-occupying intracranial lesion. The importance of a lateral pineal shift was first pointed out in 1918 by Schuller, regarded as the

father of neuroradiology. The assessment is, of course, made on anteroposterior or frontal skull films.

Detection of pineal displacement in the vertical or anteroposterior direction, as assessed on the lateral skull film is of less importance but may give an indication of the presence of tentorial pressure cone. The Americal school attaches greater value to this sign than others and numerous methods have been devised. Of these, the best known is the Vastine-Kinney method (1929). One such method has been described by the writer (Oon, 1964).

It has been the impression that the incidence of pineal calcification is appreciably lower in the people of South East Asian countries compared with those living in the Western hemisphere. However, to the best of the writer's knowledge, the incidence of pineal calcification in this region has not been reported. Arumugasamy (1966) mentioned that "in one series, 45 per cent of the adult skull had calcified pineals" but did not state where the study was made.

Most studies on the incidence of pineal calcification were made by visualising the gland on the lateral skull film. The identification of the calcified gland on the anteroposterior view is more important but the gland may be obscured, depending on radiographic projection, by the crista galli, the wall of the frontal sinuses, the calcified falx cerebri and the occipital protuberances. For the purpose of comparison, this project was based on a study of lateral skull radiographs of our local subjects.

A difficulty encountered early in the investigation is the fact that the habenular commissure which is situated immediately anterior to the pineal gland may be calcified. The phenomenon of habenular calcification is familial to anatomists for some time but it is not known to radiologists until the reports of Smith (1953) and Stauffer, Snow and Adams (1953).

The habenular calcification varies from a barely discernible fleck to a C-shape mass of calcium with the open end of the C facing backwards. This calcification may occur independently of pineal calcification and it is possible there was some confusion between the two types of calcification among earlier investigators. For the purpose of this study, habenular calcification has not been considered.

Material, method and results:

Patients referred from the Emergency Unit, usually as cases of head injury, were chosen for this study. The series consisted of skull x-rays of 1,250 cases, comprising 250 cases each in age-groups of 20-29, 30-39 40-49, 50-59 and 60 years and over. The cases in the respective age-groups were unselected though where the skull films were radiographically unsatisfactory, the cases were not included for study. The value and significance of the use of this method will be discussed later.

The breakdown of the whole series into ethnic groups is given in Table I. When compared with the racial distribution of the population as a whole (Arumainathan, 1970), the Indians were relatively more numerous in this study-group. This is probably due not to the fact that the Indians were more accident-prone; but to the observation that Indians, more than the Chinese and Malays, readily sought conventional medical care (Shanmugaratnam, 1973).

The results are presented in Table II. Table III gives the age-structure of the Singapore population in 1970 (Arumainathan, 1970).

Discussion:

The use of this somewhat unorthodox method in computing the incidence of pineal calcification has some decided advantage. The estimation was based on age groups of a specified number and it is essential that the subjects of each age-group were unselected and made up to a significant size.

The incidence of pineal calcification in the local adult population can be assessed, once the frequency of calcification in each age-group is worked out and the age-structure of the population is known from recent census or other sources. It is recognised that there is a definite trend towards longevity with improved health care. Given this consideration, it would appear this method is superior to the usual method which entails a haphazard collection of subjects.

The incidence of pineal calcification varied from 23 per cent in the 20-29 age-group to 41 per cent in the 60 and over age-group. The weighted mean incidence is estimated at 30.4 per cent based on the population statistics of 1970. This is appreciably less than figures encountered in the Western population groups.

Table I

Ethnic Group Distribution

Age–group	Chinese	Malays	Indians	Others
20–29	204	24	16	6
30–39	184	26	34	6
40–49	158	23	67	2
50–59	170	21	55	4
60 and above	213	15	18	4
Total	929	109	190	22
Percentage	74.3	8.7	15.2	1.8
Percentage of racial distribution in population (1970)	76.2	15.0	7.0	1.8

Table II

Incidence of pineal calcification

Age–group	Positive	Negative
20–29	57 (22.8%)	193
30–39	74 (29.6%)	176
40–49	80 (32.0%)	170
50–59	99 (39.6%)	151
60 and above	102 (40.8%)	148

Table III

Age–structure of adult population in Singapore (1970)

Age-Group	Number	Percentage of adult population
20- 29	336,480	32.9
30–39	249,276	24.4
40–49	182,623	17.8
50–59	136,588	13.3
60 and above	118,287	11.6
Total	1,023,254	100

It is assumed that all studies of pineal calcification incidence were made with skull films of optimal quality as small pineal calcification may be overlooked or may not be visible if the films are incorrectly exposed or are unsharp. The incidence should also be viewed in the light that in the earlier series, the habenular calcification might have been mistaken for the pineal calcification where the latter

was not visible. However, recent estimation as by du Boulay and O'Connell confirmed that in Western countries, the incidence of pineal calcification in adults ranges from 50 to 70 per cent.

Another source of confusion is the calcification of the choroid plexuses of the lateral ventricle. The calcification is more posteriorly situated and is usually composed of small discrete calcifications making up one or usually two groups of larger but fainter opacities. The differentiation from the pineal calcification can usually be made with ease from the anteroposterior view.

The skull configuration may also be a factor in the computation. The skulls of Caucasians are usually dolichocephalic, i.e. longer than broad. The Indians, especially the Northern Indians of Aryan stock have this skull configuration more than the Southern Indians who are derived from the Dravidian stock (Crooke, 1969). The Chinese and the Malays, on the other hand, have a mesocephalic or brachycephalic skull. The visualisation of a small calcified structure like the pineal is dependent to some extent on the thickness of brain tissue penetrated by x-rays. Thus, in the dolichocephalic skull, the slightly smaller width of the cranium may permit a better visualisation of the calcified pineal than in other types. However, it is believed the advantage is most probably not significant.

The incidence of pineal calcification, as visualised on the anteroposterior or frontal view has not, to the writer's knowledge, been worked out. By the rule of the thumb, it is usually seen in half of the subjects in whom the pineal calcification is visible on the lateral view. The low incidence of pineal calcification in the local population presents a definite handicap as the radiologist is more frequently deprived of a simple and valuable means of detecting brain shift.

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