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Cone-Beam CT Evaluation of Intracranial Physiological Calcifications by Age and Gender

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ABSTRACT

Objective: To assess the prevalence of physiological intracranial calcifications detected in cone-beam computed tomography (CBCT) images in a group of Turkish population by age and gender.

Methods: Full head CBCT images of 1000 patients (535 men, 465 women) with age range of 6-91 years were retrospectively analyzed. The presence of habenular, pineal gland, coroid plexus, petroclinoid ligament, interclinoid ligament, carotico-clinoid ligament, falx cerebri, tentorium cerebelli and basal ganglia calcifications were investigated by age groups and gender. Mann Whitney U test was used to calculate the calcification frequency by mean age and $\chi 2$ test was used for gender.

Results: CBCT examination of 1000 cases aged between 6 and 91 were evaluated in six groups respectively; ages under 19 (13.3%), age 20-29 (14.8%), age 30-39 (11.9%), age 40-49 (19.3%), age 50-59 (20.9%) ages over 60 (19.8%). Habenular calcification was the most common calcification with a rate of 69%. Only petroclinoid ligament calcification was significantly higher in men ($p< .001$). Statistically significant relationship was found between age groups and calcifications of habenular, pineal gland, choroid plexus, petroclinoid ligament, interclinoid ligament, caroticoclinoid ligament ($p< .001$).

Conclusion: Habenular calcification was the most common type of intracranial calcification in all age groups. As the probability of calcification increases with aging, an increase in the association of calcifications was observed. Physiological intracranial calcifications may be an incidental finding frequently encountered in CBCT examinations.

Keywords: Cone-beam computed tomography, intracranial calcifications, habenular, pineal gland, choroid plexus

1. INTRODUCTION

Intracranial calcifications may be physiological or pathological as a result of mineral or metal deposition in blood vessels, glands, cortices, or other structures in the brain (1). Physiological ones are generally not accompanied by the disease (2). Degenerative alterations and aging are considered to be related to physiological calcifications, but the reason is not fully understood (3). Various imaging techniques can be used to diagnose intracranial calcifications, but over the past decade, cone beam computed tomography (CBCT) has become one of the most preferred visualization systems for evaluating the anatomical structure of the head and neck region (4). CBCT provides images with high diagnostic values with short scanning time and low radiation dose (5, 6) . The most common locations for intracranial physiological calcifications are the pineal gland, habenular commissure, choroid plexus, falx, basal ganglia, and vessel walls (4). The pineal gland, a neuroendocrine organ resembling a small pine cone, regulates circadian rhythm and sleep by secreting the hormone melatonin (7). When the size of pineal gland calcification is over 14 mm, the possibility of a pathological lesion (pinealoma, teratoma) increases (4). The habenular commissure is a pair of small nuclei that are anatomically associated to the epitalamus and pineal gland (8). Choroid plexus calcification is mostly seen in the atrial parts of the lateral ventricles. It is rare in the third or fourth ventricle and in patients under 9 years of age (2). Choroid plexus calcification is usually related to frontal cortex, parietal-temporal, and cerebellum atrophies and is one of the neuroimaging findings of cognitive impairment in schizophrenia (9). Areas with thicker dura mater, such as the falx and petroclinoid ligaments, often tend to calcification (2). The petroclinoid ligament is the dura mater folds that extend between the petrosal part of the temporal bone the anterior and posterior clinoid process (10). Petroclinoid ligament is associated with the trigeminal, abducens, and oculomotor nerves. its calcification or ossification can cause trigeminal neuralgia (11). The clinoid process, the attachment sites for the dura mater, is located on the

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sphenoid bone. The anterior and posterior clinoid processes are interconnected by interclinoid ligament. The medial and anterior clinoid processes are connected to each other by caroticoclinoid ligament. These ligaments can sometimes ossify. Although the ossification of the interclinoid ligament is underestimated, cadaver studies have shown that the existence of the ossified interclinoid ligament makes it difficult to remove the anterior clinoid process, especially in the existence of aneurysm, and increases the risks (12, 13). Ossification of the caroticoclinoid ligament may also be associated with clinical problems such as pressure on the internal carotid artery (14). Falx calcifications usually have a characteristic appearance as dense and flat plaques and in the midline of the cerebrum (15). It has been reported that 70-80% of basal ganglia calcifications are related with hypoparathyroidism (16).

There are limited number of studies on intracranial calcifications in the literatüre (17-20). As far as we know, only the relationships between pineal gland, habenular, and choroid plexus calcifications were evaluated. The aim of this study was to investigate the frequency of intracranial calcifications according to six age groups and gender on CBCT images of a group of Turkish population and to examine the relationships between the following parameters: pineal gland, habenular, choroid plexus, petroclinoid ligament, interclinoid ligament, caroticoclinoid ligament, falx cerebri, basal ganglia, tentorium cerebelli.

2. MATERIALS AND METHODS

The current study was approved by the Ethics Committee of the Gaziantep University (Approval No: 2020/387). In this study, all facial CBCT images of the patients who applied to Gaziantep University Dentomaxillofacial Radiology Department for various reasons were retrospectively analyzed. Patients with congenital disorders, bone disease, history of trauma, surgery, tumor or malignancy, and images containing artifacts were excluded from the study. Full head CBCT images of 1000 patients (535 men, 465 women) with age range of 6-91 years were retrospectively analyzed with Planmeca ProMax 3D Mid (Helsinki, Finland) device and Planmeca Romexis version 3.2.0 software (Helsinki, Finland). Images with a field of view (FOV) range of 16x16 cm, voxel resolution of 0.4 mm3 and a slice thickness of 1 mm were used. All CBCT scans were performed according to a standard screening protocol. The images were examined in multiplanar (axial, sagittal and coronal) sections by two dentomaxillofacial radiologists, one is (MED) and the other with 9 years of experience (EDY). The hyperdense area seen in the relevant area examined in the images was accepted as calcification. Pineal gland, habenular, choroid plexus, petroclinoid ligament (Figure 1), interclinoid ligament, caroticoclinoid ligament, falx cerebri (Figure 2), basal ganglia and tentorium cerebelli (Figure 3) calcifications were investigated on the images. All these parameters were assessed according to age and gender, it was also investigated whether there was a relationship between the parameters.

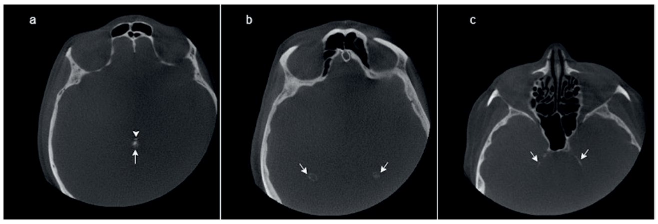

Figure 1. *Axial CBCT images show (a) habenular calcification (short arrow), pineal gland calcification (arrow), (b) choroid plexus calcification (arrowheads), (c) petroclinoid ligament calcification (arrowheads).*

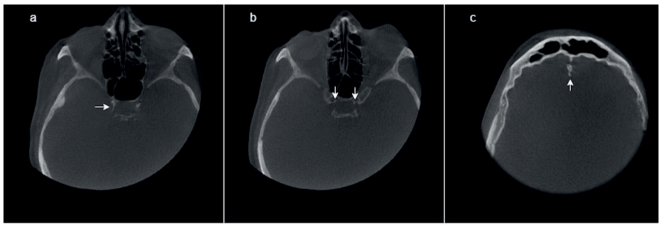

Figure 2. *Axial CBCT images demonstrate (a) interclinoid ligament calcification (arrow), (b) caroticoclinoid ligament calcification (arrows), (c) falx cerebri calcification (arrow).*

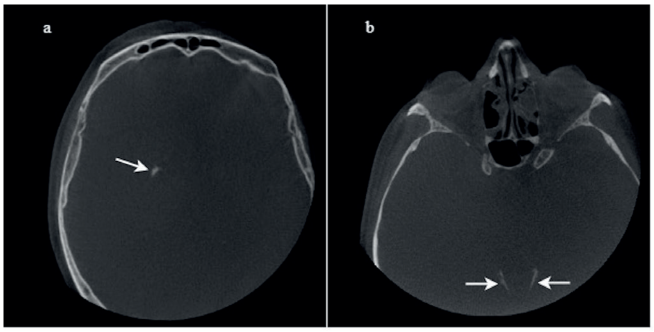

Figure 3. *Axial CBCT images indicate (a) basal ganglia calcification (arrow), (b) tentorium cerebelli calcification (arrows).*

When there was disagreement among observers, consensus was reached through discussion. For the reliability of the intraobserver calibration and assessments, the images were reviewed by the same observers two weeks after the initial assessment.

Statistical analysis of the study was performed with SPSS program version 20.0 (Armonk, NY, IBM). In the analysis of the data, Mann Whitney U test was used to calculate the frequency of calcification by mean age. Relationship between the age groups and calcifications and the prevalence difference between men and women were analyzed using the $\chi 2$ test. The grade of importance was set at $p<.05$.

3. RESULTS

The coefficient of intra and inter-observer reliability for all the assessments was found to be excellent (0.91 and 0.88, respectively). CBCT examination of 1000 cases aged between

6 and 91 were evaluated in six groups respectively; ages under 19 (13.3%), age 20-29 (14.8%), age 30-39 (11.9%), age 40-49 (19.3%), age 50-59 (20.9%) ages over 60 (19.8%). The cases consisted of 535 (53.5%) men and 465 (46.5%) women with a mean age of 42.9 years. Intracranial calcification was observed in 826 (82.6%) of 1000 CBCT images. It was detected in 82.5% of men and 82.7% of women. The prevalence of at least one calcification is shown in Table 1.

Table 1. *The prevalance of at least one intracranial calcification*

		Gender		Total N (%)
		Female	Male	
Intracranial Calcification	Absent N (%)	81 (17.3)	93 (17.5)	174 (17.4)
	Present N (%)	388 (82.7)	438 (82.5)	826 (82.6)
Total N (%)		469 (100)	531 (100)	1000 (100)

Habenular calcification was the most common calcification with a rate of 69%. Other calcifications were as follows, respectively: pineal gland 53.2%, choroid plexus 44.6%, petroclinoid ligament 10.9%, interclinoid ligament 8.2%, caroticoclinoid ligament 8.8%, falx cerebri 0.5%, tentorium cerebelli 0.2%, basal ganglia 0.2%. The distribution of the calcifications by gender is demonstrated in Table 2. When examined by gender, only the petroclinoid ligament was found to be significantly more common in males than females (p <.001).

Table 2. *Distribution of the calcifications according to gender*

Calcifications		Gender		p
		Female N (%)	Male N (%)	
Habenular	Absent	156 (33.3)	154 (29.0)	.146
	Present	313 (67.7)	337 (71.0)	
Pineal gland	Absent	232 (49.5)	236 (44.4)	.112
	Present	237 (50.5)	295 (55.9)	
Choroid plexus	Absent	251 (53.5)	303 (57.1)	.261
	Present	218 (46.5)	228 (42.9)	
Petroclinoid ligament	Absent	440 (93.8)	451 (84.9)	< .001*
	Present	29 (6.2)	80 (15.1)	
Interclinoid ligament	Absent	427 (91.0)	491 (92.5)	.413
	Present	42 (9.0)	40 (7.5)	
Caroticoclinoid ligament	Absent	428 (91.3)	484 (91.1)	.951
	Present	41 (8.7)	47 (8.9)	
Falx cerebri	Absent	465 (99.1)	530 (99.8)	.192
	Present	4 (0.9)	1 (0.2)	
Tentorium cerebelli	Absent	468 (99.8)	530 (99.8)	.000
	Present	1 (0.2)	1 (0.2)	
Basal ganglia	Absent	467 (99.6)	531 (100)	.220
	Present	2 (0.4)	0 (0.0)	

**p< .05*

The distribution of presence and absence of calcifications by mean age is indicated in Table 3. A statistically significant difference was found between the presence and absence of habenular, pineal gland, choroid plexus, petroclinoid ligament, interclinoid ligament, caroticoclinoid ligament calcifications, according to the mean age (p<.001). The presence of these calcifications was significant in advanced age. There was no significant difference according to mean age for falx cerebri, tentorium cerebelli, basal ganglia calcifications.

*T**able 3.** Distribution of the calcifications by mean age*

Calcifications		N (%)	Mean ± SD	p
Habenular	Absent	310 (31)	34.96 ± 18.46	< .001*
	Present	690 (69)	46.53 ± 16.59	
Pineal gland	Absent	468 (46.8)	37.13 ± 18.35	< .001*
	Present	532 (53.2)	47.91 ± 16.14	
Choroid plexus	Absent	554 (55.4)	37.13 ± 18.33	< .001*
	Present	446 (44.6)	50.17 ± 14.66	
Petroclinoid ligament	Absent	891 (89.1)	41.99 ± 18.22	< .001*
	Present	109 (10.9)	50.72 ± 13.81	
Interclinoid ligament	Absent	918 (91.8)	41.22 ± 17.42	< .001*
	Present	82 (8.2)	62.23 ± 12.25	
Caroticoclinoid ligament	Absent	912 (91.2)	40.93 ± 17.36	< .001*
	Present	88 (8.8)	63.85 ± 8.75	
Falx cerebri	Absent	995 (99.5)	42.9 ± 18	.262
	Present	5 (0.5)	51.4 ± 16.68	
Tentorium cerebelli	Absent	998 (99.8)	43 ± 17.97	.035
	Present	2 (0.2)	15 ± 4.24	
Basal ganglia	Absent	998 (99.8)	42.91 ± 17.97	.316
	Present	2 (0.2)	60.5 ± 28.99	

**p< .05*

The distribution of the calcifications by age groups is given in Table 4. A statistically significant relationship was found between age groups and calcifications of habenular, pineal gland, choroid plexus, petroclinoid ligament, interclinoid ligament, caroticoclinoid ligament (p<.001). While habenular calcification is not observed in 66.2% of individuals aged 19 and under, it is seen in 82.3% of individuals aged 60 and above. While pineal gland calcification is not detected in 82% of individuals aged 19 and under, it is seen in 69.7% of individuals aged 60 and over. In addition, choroid plexus, petroclinoid ligament, interclinoid ligament, caroticoclinoid ligament calcifications were also detected more frequently in advanced ages.

The binary relationships of calcifications with each other are indicated in Table 5. In the absence of petroclinoid ligament calcification, the absence of caroticoclinoid ligament calcification was 82.2% (p= .001) and the absence of interclinoid ligament calcification was 86.6% (p<.001). In the absence of caroticoclinoid ligament calcification, the presence of habenular and pineal gland calcification was 61.8% and 46.5%, respectively (p<.05). In the absence of interclinoid ligament calcification, the presence of habenular and pineal gland calcification was 62% and 47.8%, respectively (p<.05). In the absence of petroclinoid ligament calcification, the presence of habenular and choroid plexus calcification was 60.5% and 38.6%, respectively (p<.05).

***Table 4.** Distribution of the calcifications by age groups*

		Habenular	Pineal gland	Choroid plexus	Petroclinoid ligament	Interclinoid ligament	Caroticoclinoid ligament
Age groups		**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**N (%)**
< 19	**Presence**	45 (33.8)	24 (18.0)	8 (6.0)	1 (0.8)	2 (1.5)	0 (0.0)
	Absence	88 (66.2)	109 (82.0)	125 (94.0)	132 (99.2)	131 (98.5)	133 (100)
	Total	133 (100)	133 (100)	133 (100)	133 (100)	133 (100)	133 (100)
20-29	**Presence**	92 (62.2)	66 (44.6)	39 (26.4)	12 (8.1)	0 (0.0)	0 (0.0)
	Absence	56 (37.8)	82 (55.4)	109 (73.6)	136 (91.9)	148 (100)	148 (100)
	Total	148 (100)	148 (100)	148 (100)	148 (100)	148 (100)	148 (100)
30-39	**Presence**	88 (73.9)	66 (55.5)	54 (45.4)	7 (5.9)	3 (2.5)	0 (0.0)
	Absence	31 (26.1)	53 (44.5)	65 (54.6)	112 (94.1)	116 (97.5)	119 (100)
	Total	119 (100)	119 (100)	119 (100)	119 (100)	119 (100)	119 (100)
40-49	**Presence**	137 (71.0)	112 (58.0)	98 (50.8)	29 (15.0)	4 (2.1)	6 (3.1)
	Absence	56 (29.0)	81 (42.0)	95 (49.2)	164 (85.0)	189 (97.9)	187 (96.9)
	Total	193 (100)	193 (100)	193 (100)	193 (100)	193 (100)	193 (100)
50-59	**Presence**	165 (78.9)	126 (60.3)	124 (59.3)	29 (13.9)	20 (9.6)	22 (10.5)
	Absence	44 (21.1)	83 (39.7)	85 (40.7)	180 (86.1)	189 (90.4)	187 (89.5)
	Total	209 (100)	209 (100)	209 (100)	209 (100)	209 (100)	209 (100)
> 60	**Presence**	163 (82.3)	138 (69.7)	123 (62.1)	31 (15.7)	53 (26.8)	60 (30.3)
	Absence	35 (17.7)	60 (30.3)	75 (37.9)	167 (84.3)	145 (73.2)	138 (69.7)
	Total	198 (100)	198 (100)	198 (100)	198 (100)	198 (100)	198 (100)
	p	< .001	< .001	< .001	< .001	< .001	< .001

**p< .05*

***Table 5.** The relationships of calcifications with each other*

Calcifications		Caroticoclinoid ligament			Interclinoid ligament			Petroclinoid ligament			Choroid plexus			Pineal gland		
		Absent N (%)	Present N (%)	p	Absent N (%)	Present N (%)	p	Absent N (%)	Present N (%)	p	Absent N (%)	Present N (%)	p	Absent N (%)	Present N (%)	p
Habenular	**Absent**	294 (29.4)	16 (1.6)	.006*	298 (29.8)	12 (1.2)	.001*	286 (28.6)	24 (2.4)	.032*	220 (22.0)	90 (9.0)	.001*	259 (25.9)	51 (5.1)	.001*
	Present	618 (61.8)	72 (7.2)		620 (62.0)	70 (7.0)		605 (60.5)	85 (8.5)		334 (33.4)	356 (35.6)		209 (20.9)	481 (48.1)	
Pineal	**Absent**	447 (44.7)	21 (2.1)	< .001*	440 (44.0)	28 (2.8)	.017*	426 (42.6)	42 (4.2)	.067	302 (30.2)	166 (16.6)	.001*	-	-	-
	Present	465 (46.5)	67 (6.7)		478 (47.8)	54 (5.4)		465 (46.5)	67 (6.7)		252 (25.2)	280 (28.0)		-	-	
Choroid plexus	**Absent**	524 (52.4)	30 (3.0)	< .001*	521 (52.1)	33 (3.3)	.004*	505 (50.5)	49 (4.9)	.020*	-	-	-	-	-	-
	Present	388 (38.8)	58 (5.8)		397 (39.7)	49 (4.9)		386 (38.6)	60 (6.0)		-	-		-	-	
Petroclinoid ligament	**Absent**	822 (82.2)	69 (6.9)	.001*	828 (82.8)	63 (6.3)	.001*	-	-	-	-	-	-	-	-	-
	Present	90 (9.0)	19 (1.9)		90 (9.0)	19 (1.9)		-	-		-	-		-	-	
Interclinoid ligament	**Absent**	866 (86.6)	52 (5.2)	< .001*	-	-	-	-	-	-	-	-	-	-	-	-
	Present	46 (4.6)	36 (3.6)		-	-		-	-		-	-		-	-	

**p< .05*

4. DISCUSSION

There are simply two studies in the literature examining intracranial calcifications with CBCT (17, 18). In these, only the relationships between pineal gland, habenular and choroid plexus calcifications were evaluated. As far as we know, this is the merely study in which the prevalence of nine physiological intracranial calcifications detected on CBCT images was investigated according to age and gender.

According to our findings, the most common calcification was habenular calcification in all age groups. In respect to gender, only petroclinoid ligament calcification was found to be significantly more common in males than females.

CBCT is widely used in dental diagnosis and treatment planning before and after surgical procedures, and can also be used in the evaluation of intracranial calcifications as it allows imaging of bone and calcified structures. The detectability of calcification on computed tomography (CT) can be influenced by a number of factors and levels, such as slice thickness and window width (18). CBCT has made it possible to obtain clearer images by allowing the target structure to be examined in all directions of space by taking different cross-sectional images to reveal anatomical variations, high resolution, detail reflection capacity, clarity in hard tissue imaging, low metal artifact, ease of use and relatively low radiation dose (21). Intracranial calcifications are often an incidental finding on a wide FOV CBCT scan. Therefore, clinicians can contribute to early diagnosis and prevention. Since most dental implant patients are middle-aged or older, the possibility of examining neurodegenerative calcifications in these patients is ideal (22). Detection of soft tissue calcifications is generally made according to their anatomical location, distribution and morphological features in radiographic images. It has been reported that the increase in the size of some physiological calcifications may be pathological calcification or pathological lesion (4, 23). To distinguish whether the calcification is physiological or pathological, if it is larger than 1 cm and seen in children under 9 years of age, it may suggest that it is pathological. They may not have symmetrical borders compared to irregular physiologic calcifications or may be located in different areas than those where physiologic calcifications are commonly seen. (15,17, 24).

Physiological intracranial calcifications are generally asymptomatic and sometimes symptomatic depending on their location and extent (25). Intracranial calcifications and ossifications may cause pressure on anatomic neighborhoods or complications in the surgery of that area (26). Jassim et al. (25) observed intracranial calcification in 58.6% of the cases. Sedghizadeh et al. (17) reported that 35.2% of the cases had intracranial calcification. In the study of Bayrak et al. (18), the prevalence of intracranial physiological calcifications was found to be 33.1%. Unlike previous studies, this rate was 82.6% in our study.

Pineal gland calcification is observed as a well-circumscribed radiopaque mass in the midline plane on radiography. The size of these calcifications ranges from approximately 1 mm to 7 mm, with an average diameter of 4 mm. Calcifications of 1 cm or greater may indicate the presence of neoplasm (15, 17). In the literature, the pineal gland calcification rates on CT were as follows; 73%, 71.6%, 71%, 68.5%, 68%, 67.7%, 66.1%, 46.2% (1, 6, 19-20, 25, 27-29). In studies conducted in CBCT, these rates were as follows; 80% (pineal / habenular region), 64.5%, 58.8%, 19.2%, 12.92% (17, 22, 23, 30, 31). In the present study, this rate was 53.2%. It can be thought that the reason why the result we obtained is different from other studies is the high number of scanned images, the wide age range and ethnic origin.

The habenular commissure is situated in the upper layer of the stem of the pineal gland (32, 33). While the role of the habenular commissure is unknown, the habenular nuclei play a significant role in influencing how the brain reaction to diverse stimuli such as fear, ache, award, stress, and sleep (34). Habenular commissure is usually reported to be calcified on skull radiographs and CT imaging (35). In previous studies, the prevalence of this calcification was 80%, 35.2%, 20.1%, 19.2%, 6.4% (1, 17, 19-20, 25). Only one of them was a CBCT study, and in that study, the habenular and pineal regions were examined together (17). In our study, habenular and pineal were assessed separately and habenular calcification was found in 69%. The reason why this ratio is different from other studies may be due to population differences. There are very few studies examining choroid plexus calcification with CBCT. In these studies, choroid plexus calcification was detected in 12%, 2.4%, 1.7% (17, 18, 26). In studies performed with CT, choroid plexus calcification was observed in 81.6%, 70.2%, 69.3%, 66.2%, 56.82% and 53.6% (1, 19, 20, 22-25, 28, 29). The ratio in our study was higher than studies with CBCT and lower than studies with CT. We think that the different frequencies in the studies are due to the mineralization mechanism, genetic factors, hormonal values and population differences.

In studies performed with CBCT, petroclinoid ligament calcification was reported in 33.4%, 8% and 2.7% (17, 18, 26). In a study with CT, this rate was found to be 18.3% (36). In our study, this rate was observed as 10.9%. Unlike other studies, it was determined more in men than in women. This difference may be due to the geographical region and ethnic origin of the people whose data were used in the study.

Interclinoid and caroticoclinoid ligament calcification might induce dysfunction of left eye muscles because of possible compression of the carotid artery or oculomotor nerve (37). Only one CBCT study was found in literature and the prevalence was 4.88% (18). In study of Cederberg et al. (25) evaluating the prevalence of interclinoid ligament calcification on lateral cephalometric radiographs, it was found to be 8%. Erturk et al. (37) detected interclinoid calcification at a rate of 8.18% in their cadaver study and 7.89% in Ozdogmuş et al. (12)'s autopsy study. In the current study, interclinoid ligament calcification was found to be 8.2%, which is consistent with previous studies. There is only one study in the literature examining caroticoclinoid ligament ossification or calcification with CBCT. Bayrak et al. (18) reported 3.83% caroticoclinoid ossification in their study. In our study, this rate was 8.8%. The reason for this difference may be the larger number of images examined and the wide age range.

Dorenbeck et al. (38) reported that tertiary hyperparathyroidism and chronic renal failure may cause tentorium cerebelli and dural calcification. Dural (falx cerebri) calcification was found to be 12.5%, 11.2% and 6.6% in studies performed on CT (1, 19, 25). Tentorium cerebelli calcification was observed in 7.3% of CT examinations conducted by Daghighi et al (1). In previous CT researches, basal ganglia calcification was detected as 14.4%, 1.3%, 0.8% (1, 19, 25). The reason why our study is different from other studies may be the soft tissue imaging difference between CBCT and CT. As far as we can see, there are not enough studies in the literature regarding the co-occurrence of pineal gland, choroid plexus, habenular, interclinoid ligament, caroticoclinoid ligament, petroclinoid ligament, falx cerebri, tentorium cerebelli calcifications. Orcan et al. (20) stated that the calcifications of pineal gland and choroid plexus were coexistence in 51.9% of cases, pineal gland and habenular commissure in 28.7%, and choroid plexus and habenular commissure calcifications in 28.4% of cases. We think that the reason why associations with interclinoid and caroticoclinoid ligaments are less common is that these calcifications occur at a later age than others. Different the previous study, the most common coexistence of habenular and pineal calcifications was seen in our study.

In the study by Daghighi et al. (1), pineal calcification was the most prevalent calcification between individuals aged 15 to 54 years, whereas choroid plexus was the most prevalent calcification in individuals aged 55 to 85 years. Habenular calcification ranked third in all age groups. In our study, the most common calcification in all age groups was habenular calcification. Calcification of the choroid plexus and pineal gland increased in cases over 50 years of age. Petroclinoid ligament calcification increased over 40 years of age, while interclinoid and caroticoclinoid calcifications were observed more frequently over 60 years of age. Unlike other calcifications, caroticoclinoid ligament calcification was not observed before the age of 40. The reason for this difference may be the population discrepancy and the large number of individuals we included in the study.

The limitation of this study was that it was a retrospective study, so systemic diseases of the patients, hormone levels, blood calcium and iron levels and the drugs they used were not known.

Though the reasons of intracranial calcifications are not fully known, factors such as age, gender, race, geographical region, nutrition and lifestyle might influence their formation (39, 40). Intracranial calcifications and ossifications may cause pressure on anatomic neighborhoods or complications in the surgery of that area. Therefore, the presence of calcifications that can be easily visualized with CBCT in regional surgery should be carefully examined. Due to the larger number of data examined, it is considered that the results we obtained will be a solid data source in this region's population. In future studies, multicenter studies can be planned in different populations by increasing the sample size, and it may be useful to investigate these calcifications with the use of magnetic resonance imaging.

5. CONCLUSION

In this study, the most common type of intracranial calcification in all age groups was habenular, followed by the pineal gland and choroid plexus on CBCT images. Petroclinoid ligament calcification was significantly more common in males than females. The probability of calcification increased with aging, and a tendency to increase was detected in the association of calcifications. Among all calcifications, habenular and pineal gland calcifications were most common observed together. Physiological intracranial calcifications may be an incidental finding frequently encountered in CBCT examinations.

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Author Contribution

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Design of the study: EDY, MED

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