

# Computed Tomographic Pattern of Intracerebral Calcifications in a Radiology Center in Benghazi, Libya

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## Abstract

**Background:** Intracranial calcification (ICC) is frequently seen in noncontrast computed tomography (NCCT) in both adult and pediatric populations. **Aim:** We performed this study in order to illustrate and provide data regarding the CT pattern of ICC among adult patients. **Setting and Design:** This was a retrospective study of patients who underwent nonenhanced CT of the brain in the radiology center in Benghazi, Libya. **Materials and Methods:** This was a retrospective analysis of patients who underwent NCCT of the head at a radiology center in Benghazi, Libya, from the period of May to December 2017. NCCT scan head was performed with a standardized protocol, using axial and bone window images as well as Hounsfield unit measurement for final evaluation. CT aspects of ICCs were illustrated. Data were expressed as median and ranges (numerical) or as number and percentage (categorical). Nonparametric Mann–Whitney *U*-test was used for comparison between unpaired groups. **Results:** We determined ICC in 159 patients, of which 88 (55%) were male. The median age was 66 (19–95) years. The most common site of ICC is pineal body representing 138 (86.8%), followed by choroid plexus, 136 (85.5%), falx cerebri 31 (19.5%), and basal ganglia 18 (11%). Calcification of the middle cerebral artery was seen in two patients only. **Conclusions:** We determined the frequency of different intracerebral calcifications in adult patients which provide new data in our setting that can be utilized in clinical use. This finding is similar to that reported in other studies.

**Keywords:** Clinical utilization, computed tomography, intracranial calcification

## INTRODUCTION

Intracranial calcifications (ICCs) refer to calcifications within the brain parenchyma or vasculature.<sup>[1]</sup> These include physiological/age-related and pathological calcifications.<sup>[2]</sup> Noncontrast computed tomography (NCCT) of the head remains the modality of choice in detecting ICC even in asymptomatic patients.<sup>[3-5]</sup> Description of the location, size, and shape of calcification is essential as it helps to diagnose specific pathological conditions.<sup>[1]</sup> Previous reports suggest that the prevalence ranges from 1% in young individuals to up to 20% in the elderly.<sup>[6]</sup> However, we lack epidemiological data on ICC in our local centers. In this study, we present different aspects of ICC in adult patients who underwent an NCCT scan of the head in order to provide data regarding this issue which may have a clinical perspective and utilization.

## MATERIALS AND METHODS

This was a retrospective analysis of patients who underwent

NCCT of the head at a radiology center in Benghazi, Libya, from the period of May to December 2017. NCCT scan head (SIEMENS Somatom Balance Single Slice Spiral CT Scan) was performed with a standardized protocol, using axial and bone window images as well as Hounsfield unit (HU) measurement for final evaluation. The indications for NCCT scan of the brain included headache, cerebrovascular disease, trauma, dizzy spells, and dementia. CT aspects of ICCs were illustrated among the whole study population as well as in subgroups of different age distributions.

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The numerical data were expressed as median and ranges and categorical data as number and percentage. Nonparametric Mann–Whitney *U*-test was used for comparison between unpaired groups. Statistical analysis was performed using the statistical program Statistical Package for the Social Sciences (SPSS) version 18.0. (SPSS Inc, Chicago, USA).

## RESULTS

Out of all patients who underwent a CT scan of the head during a 7-month period, 159 were found to have ICC, of which 88 (55%) were male. The median age was 66 (19–95) years. We found a statistically significant difference in the age (59.5 [19–92] years vs. 69 [24–95] years,  $P < 0.01$ ) between men and women. The included patients had different reasons to perform a CT scan of the brain. The most encountered reason is cerebrovascular accident (CVA), which was seen in 44 (28%) patients, followed by headache (37, 23%), head trauma (21, 13%), fall down (15, 9.4%), dizzy spells (14, 8.8%), and follow-up scan (13, 8.2%). Dementia and memory loss were encountered in six patients (3.8%). Other symptoms include gait disturbance, acute confusion state, and cerebellar tumor (collectively 5 patients, 3.1%). The remaining four patients (3%) were referred to do CT scan without clear reason [Table 1].

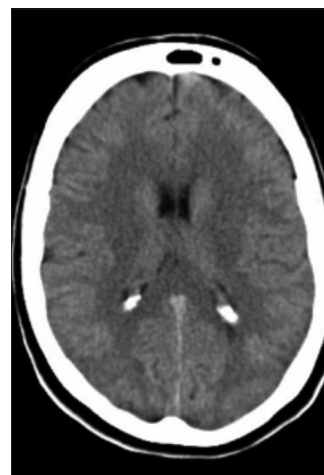
### Areas of calcification in computed tomography scan

Calcifications are detected in different structures: the choroid plexus [Figure 1], pineal body [Figure 2], falx cerebri [Figure 3], basal ganglia [Figure 4], and the vasculature, specifically middle cerebral artery (MCA). Of 159 patients, 138 (86.8%) had pineal body calcification, 136 (85.5%) had choroid plexus calcification, 31 (19.5%) had falx cerebri

calcification, 18 (11%) had basal ganglia calcification, and only 2 (1.3%) patients had MCA calcification [Table 1]. HU measurement in the pineal body, choroid plexus, falx cerebri, basal ganglia, and MCA was 82–484, 86–500, 100–1096, 70, and 70–114, respectively.

### Subgrouping according to age

The study population is divided according to age into four subgroups. Subgroup I includes patients younger than 40 years of age, subgroup II includes patients whose age ranges from 40 years to <55 years, subgroup III includes patients whose age ranges from 55 to 69 years, and subgroup IV includes patients who are 70 years or older. The results are demonstrated in Table 2 and Figure 5.



**Figure 1:** Computed tomography of the brain showing choroid plexus calcification

**Table 1: Characteristics of the total study population**

	Total population ( $n=159$ ), $n$ (%)	Males ( $n=88$ ; 55%), $n$ (%)	Females ( $n=71$ ; 45%), $n$ (%)	<i>P</i>
Age (years)	66 (19-95)	59.5 (91-92)	69 (24-95)	<0.01
Location, $n$ (%)				
PB	138 (86.8)	80 (91)	58 (81.7)	0.07
CP	136 (85.5)	77 (87.5)	59 (83.1)	NS
BG	18 (11)	6 (6.8)	12 (16.9)	<0.05
FC	31 (19.5)	18 (20.5)	13 (18.3)	NS
MCA	2 (1.3)	2 (2.3)	0	NS
Reason for CT, $n$ (%)				
Headache	37 (23)	22 (25)	15 (21.1)	NS
Trauma	21 (13)	17 (19.3)	4 (5.6)	NS
Stroke*	44 (28)	23 (26.1)	21 (29.6)	NS
Dizzy spells	14 (8.8)	8 (9.1)	6 (8.5)	NS
Fall down	15 (9.4)	5 (5.7)	10 (14.1)	NS
Dementia	6 (3.8)	3 (3.4)	3 (4.2)	NS
Follow-up†	13 (8.2)	5 (5.7)	8 (11.3)	NS
Others‡	5 (3.1)	4 (4.5)	1 (1.4)	NS
Unclear reason	4 (2.5)	1 (1.1)	3 (4.2)	NS

Values are expressed as median and ranges. PB: Pineal body, CP: Choroid plexus, FC: Falx cerebri, BG: Basal ganglia, MCA: Middle cerebral artery calcification, NS: Not significant. \*Stroke included ischemic infarction ( $n=37$ ), intracerebral hemorrhage (6), subarachnoid hemorrhage (1), †Head scan performed as a follow-up study after old stroke (11), subdural hematoma (1), or old head trauma (1), ‡Others denote symptoms such as gait difficulty (2), cerebellar tumor (1), and acute confusion state (2)



**Figure 2:** Computed tomography of the brain showing pineal body calcification



**Figure 4:** Computed tomography of the brain showing basal ganglia calcification

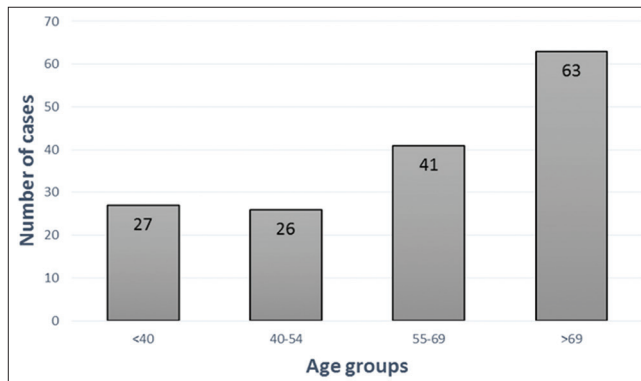
In patients younger than 40 years of age (subgroup I), we determined ICC in 27 (17%) patients, of which 20 (74%) were male. In this group, pineal body 23 (85%) and choroid plexus 18 (66.7%) were the most commonly identified structures. Headache and trauma ( $n = 12, 44\%$  and  $10, 37\%$ , respectively) were the main reasons for referral to do a CT scan of the brain.

Subgroup II includes 26 (16.4%) patients, of which 20 were male. The median age was 43.5 (40–54) years. Headache (12; 46%) was the primary reason to perform CT, and ICC was determined in the pineal body (21; 80.8%), choroid plexus (23; 88.5%), falx cerebri (3; 11.5%), and one in MCA (3.8%).

The other subgroup (subgroup III) includes 41 (25.8%) patients whose age ranges between 55 and 69. Their median age was 63 years, and 23 (56%) were female. In this subgroup, stroke was the cause to do CT scan in 13 (31.7%) patients, followed by headache in 10 (24.4%) patients. Pineal body and choroid plexus calcifications were both found in 37 (90.2%) patients, falx cerebri in 12 (29.3%), and basal ganglia in



**Figure 3:** Computed tomography of the brain showing falx cerebri calcification



**Figure 5:** Number of patients with different intracerebral calcifications according to the age

6 (14.6%) patients. No patient was recorded to have MCA calcification.

The CT scan of 63 (39.6%) patients older than 70 years of age (subgroup IV) illustrated calcification of the choroid plexus in 56 (88.9%) patients, pineal body in 55 (87.3%) patients, falx cerebri in 13 (20.6%) patients, and calcification of basal ganglia in 10 (15.9%) patients. Vascular (MCA) calcification was determined in one patient (1.6%). The main reason to refer the patient in this age group is CVA ( $n = 22, 34.9\%$ ). Dementia was a reason for referral in 6 (9.5%) patients. Nine patients (14.3%) underwent a CT scan as a follow-up study of old illness like stroke. Dizzy spells was an indication to perform CT in 8 (12.7%) patients. In contrast to young patients, women are encountered more than men when they are 55 years or older.

## DISCUSSION

This study illustrated the CT scan aspects of intracerebral calcification in adult Libyan patients in a short period of time and focused on an outpatient visit. The most common sites of brain calcifications were found to be pineal body and choroid plexus, with the highest proportion (90%) being in the fifth and sixth decades. This finding is similar to other reports on the location and extent of ICC.<sup>[7]</sup> Similar locations of ICC were also found in patients younger than 55 years with male dominance.<sup>[7]</sup> Furthermore, pineal body calcification among the whole study population was encountered more in male patients than females although statistical significance was

**Table 2: Classifications according to age**

	<40 years (n=27, 17%), n (%)	40-54 years (n=26, 16%), n (%)	55-69 years (n=41; 26%), n (%)	>69 years (n=63; 40%), n (%)
Gender, n (%)				
Males	20 (74)	20 (77)	18 (44)	30 (46)
Females	7 (26)	6 (23)	23 (56)	35 (54)
Location of ICC, n (%)				
PB	23 (85)	21 (81)	37 (90)	55 (87)
CP	18 (66.7)	23 (88.5)	37 (90)	56 (89)
FC	2 (7.4)	3 (11.5)	12 (29)	13 (21)
BG	2 (7.4)	0	6 (14.6)	10 (16)
MCA	0	1 (3.8)	0	1 (1.6)
Reasons to do CT, n (%)				
Headache	12 (44)	12 (46)	10 (24)	3 (4.6)
Trauma	10 (37)	5 (19)	5 (12)	1 (1.5)
Stroke	1 (3.7)	6 (23)	13 (31.7)	24 (37)
Dizzy spells	0	1 (3.8)	5 (12)	8 (12.3)
Fall down	2 (7.4)	0	4 (9.8)	8 (12.3)
Dementia	0	0	0	6 (9.2)
Follow-up	1 (3.7)	0	3 (7)	9 (13.8)
Others*	0	1 (3.8)	0	4 (6.2)
Unclear reason	1 (3.7)	0	1 (2.4)	2 (3.1)

Values are expressed as numbers and percentage. Others\* denote symptoms such as gait difficulty (2), cerebellar tumor (1), and acute confusion state (2). PB: Pineal body, CP: Choroid plexus, FC: Falx cerebri, BG: Basal ganglia, MCA: Middle cerebral artery calcification

not reached. A single pattern of calcification was noted in the pineal body.

Among the whole cohort, we found a statistically significant difference in the age between men and women, with women being older. This result is not compatible with previously published data by Bayrak *et al.* and Seval, who found no relationship between age, gender, and ICC.<sup>[8]</sup>

We demonstrated basal ganglia calcification, depicted in CT scan as faint calcifications, in a small proportion of patients, which is increasing among patients in their seventh decade or older. Yalcin *et al.* found that basal ganglia calcification constitutes 1.3% in their study, but unlike our study, it does not change with increased age.<sup>[7]</sup> Others reported increasing prevalence with age.<sup>[9]</sup> Interestingly, we found that basal ganglia calcifications were encountered among female patients more than males, which is similar to the reported study by Yalcin *et al.*<sup>[7]</sup> Unfortunately, we do not have biochemical correlations with parathyroid status among those patients to clarify the underlying pathological cause. Intracranial vascular calcifications seen in MCA in our study are demonstrated in two patients, and both of them were male. In previous reports, calcification of MCA was seen in 5%, vertebral artery in 20%, and internal carotid in 60%.<sup>[10]</sup> For detailed description of intracerebral vascular calcification, we need to conduct a larger study with longer duration than the current one.

In general, all types of calcifications, except that of basal ganglia, were seen predominantly in males, a finding consistent with Yalcin *et al.* and Daghighi *et al.*<sup>[4,7]</sup>

When we evaluated the reasons for referral to do a head CT scan, we found that headache and trauma were the most

frequent causes in patients younger than 55 years, whereas stroke was the main reason in patients during their seventh decade. In a previous report, Valtis *et al.* demonstrated that headache, trauma, abnormal neurological examination, and stroke were the most common indications to do a CT scan of the head.<sup>[11]</sup> However, in Valtis report, the stroke patients were younger than the stroke patients in our cohort. Overall, male dominance was noted for all causes except in the setting of fall down and follow-up of an old illness.

## CONCLUSION

We determined the frequency of different intracerebral calcifications in adult patients which provide new data in our setting that can be utilized in clinical use. We also recommend biochemical correlation in the setting of ICC in order to clarify the underlying pathological cause.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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## ملخص المقال باللغة العربية

النمط المقطعي المحسوب للتكلسات داخل الدماغ في مركز الأشعة في بنغازي، ليبيا

### المؤلفون:

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**الخلفية:** كثيراً ما يُرى التكلس داخل القحف (ICC) في التصوير المقطعي المحسوب غير المتباين (NCCT) في كل من السكان البالغين والأطفال.

**الأهداف:** أجريت هذه الدراسة لتوضيح وتقديم البيانات المتعلقة بنمط التصوير المقطعي المحسوب للتكلس داخل القحف بين المرضى البالغين.

**الإعدادات والتصميم:** هذه دراسة بأثر رجعي للمرضى الذين خضعوا للتصوير المقطعي المحسوب للدماغ في مركز الأشعة في بنغازي، ليبيا.

**المواد والأساليب:** أجري تحليل بأثر رجعي للمرضى الذين خضعوا للتصوير المقطعي المحسوب غير المتباين للرأس في مركز الأشعة في بنغازي، ليبيا للفترة من مايو إلى ديسمبر 2017م. تم إجراء الفحص بروتوكول موحد، باستخدام الزاوية المحورية والعظام وكذلك قياس وحدة هاونسفيلد للتقييم النهائي. تم توضيح جوانب التصوير المقطعي من داخل الجمجمة. تم التعبير عن البيانات كمتوسط ونطاقات (عددية) أو كرقم ونسبة مئوية (فئوية). تم استخدام اختبار مان ويتني للمقارنة بين المجموعات غير المتزاوجة. اعتبر  $P < 0.05$  ذات دلالة إحصائية.

**النتائج:** حددنا تكلس داخل القحف في 159 مريضاً، منهم 88 (55%) من الذكور. كان متوسط العمر 66 (19-95) سنة. الموقع الأكثر شيوعاً للتكلس داخل القحف هو الجسم الصنوبر الذي يمثل 138 (86.8%)، تليها الضفيرة المشيمية 136 (85.5%)، المنجل المخي 31 (19.5%)، والعقد القاعدية 18 (11%). شوهد تكلس الشريان الدماغى الأوسط في مريضين فقط.

**الاستنتاج:** تم تحديد تواتر التكلسات الدماغية المختلفة في المرضى البالغين والتي تشبه تلك المبلغ عنها في دراسات أخرى، كما أن هذه البيانات الجديدة في بيئتنا بالإمكان استخدامها سريريا.

**الكلمات المفتاحية:** الاستخدام السريري، التصوير المقطعي، التكلس داخل القحف.