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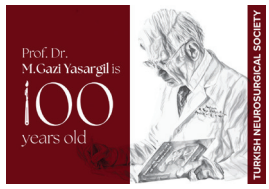

Surgical Management of Calcified Cephalohematoma in Infants

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ABSTRACT

AIM: To investigate the patients diagnosed with calcified cephalic hematoma who underwent surgery at our clinic, and to review the critical aspects of surgical management.

MATERIAL and METHODS: This study retrospectively reviewed calcified cephalic hematoma patients who underwent surgery between January 2021 and December 2023.

RESULTS: Fifteen patients with calcified cephalic hematoma who received surgical treatment were enrolled in the study (four (26.7%) female and 11 (73.3%) male). The mean age at operation was 3.5±1.9 months (min–max: 2–10). The mean follow-up duration was 23.3±9.5 months. Patients operated on at ages ≤3 months (n=10, 66.7%) and >3 months (n=5, 33.3%) were categorised into two separate groups. The calcified cephalic hematoma was detected in the parietal region in 14 patients and in the occipital region in one patient. All patients presented with complaints of scalp swelling. Furthermore, 13 (86.7%) patients underwent complicated deliveries, and two (13.3%) experienced postpartum trauma. Three patients experienced postoperative complications, including wound infection, subgaleal hematoma and epileptic seizure; blood transfusion was required in five patients (33.3%). Of note, all the patients with postoperative blood requirements were operated on at ≤3 months age.

CONCLUSION: Calcified cephalohematoma is an uncommon but serious condition that can cause significant asymmetry of the infant skull. The surgical technique employed in this study exhibited a low rate of complications and effectively restored regular cranial contours, particularly in patients with Type 1 calcified cephalohematoma and those with Type 2 calcified cephalohematoma accompanied by mild cranial depression. It was concluded that patients with calcified cephalic hematoma could be safely operated on during the first three months following birth. Nevertheless, caution should be taken regarding postoperative haemorrhage and the requirement for erythrocyte suspension replacement.

KEYWORDS: Calcified, Cephalic hematoma, Craniosynostosis, Infant, Neurosurgery

ABBREVIATIONS: CT: Computed tomography, **MRI:** Magnetic resonance imaging, **EEG:** Electroencephalography, **ES:** Erythrocyte suspension

INTRODUCTION

Cephalic hematoma results from an accumulation of blood between the skull and pericranium. The hematoma limits itself to the cranial sutures because the periosteum tightly adheres to them (6,12). In all deliveries, cephalic hematoma incidence varies between 0.2% and 2.5% (11,23).

Its aetiology includes birth trauma, haemorrhagic disorders, fetal scalp monitoring, instrumentation, significant birth weight and nulliparity. The most prevalent location is above

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the parietal bone (17,23). Cephalic hematoma typically regresses spontaneously within 4–6 weeks. Nevertheless, on infrequent occasions, calcified cephalic hematoma may result from subperiosteal osteogenesis triggered by displacement of the periosteum. Calcified cephalohematomas account for approximately 3%–5% of all cephalohematomas (21).

Patients typically present with scalp swelling. Computed tomography (CT) imaging parameters characteristic of this condition includes an enlargement of the diploe distance and calcification in the inner and outer layers. For cephalic hematomas that calcify or fail to regress spontaneously, surgical methods are considered aesthetically more favourable than other treatments (14). This study aimed to investigate patients with calcified cephalic hematomas and operated at our clinic to review the critical aspects of surgical management.

MATERIAL and METHODS

Patient Population

This retrospective study included calcified cephalic hematoma patients who underwent surgery in our clinic between January 2021 and December 2023. Clinical data regarding age, sex, symptoms, history of birth trauma, location of calcified cephalic hematoma, type of calcified cephalic hematoma, hematoma size, perioperative and postoperative blood requirements, discharge and follow-up times and complications were retrieved from medical records.

The diagnosis of calcified cephalic hematoma was based on physical examination findings and imaging modalities, including CT and magnetic resonance imaging (MRI) (Figure 1). CT was routinely used for diagnosis. To better characterise the calcified cephalic hematoma and assess the presence of calvarial abnormalities, preoperative brain CT was performed on all operated patients. MRI was employed as an alternative imaging modality.

Only patients who underwent surgery for calcified cephalohematoma and had complete radiological imaging as well as comprehensive postoperative follow-up data and duration were included in this study.

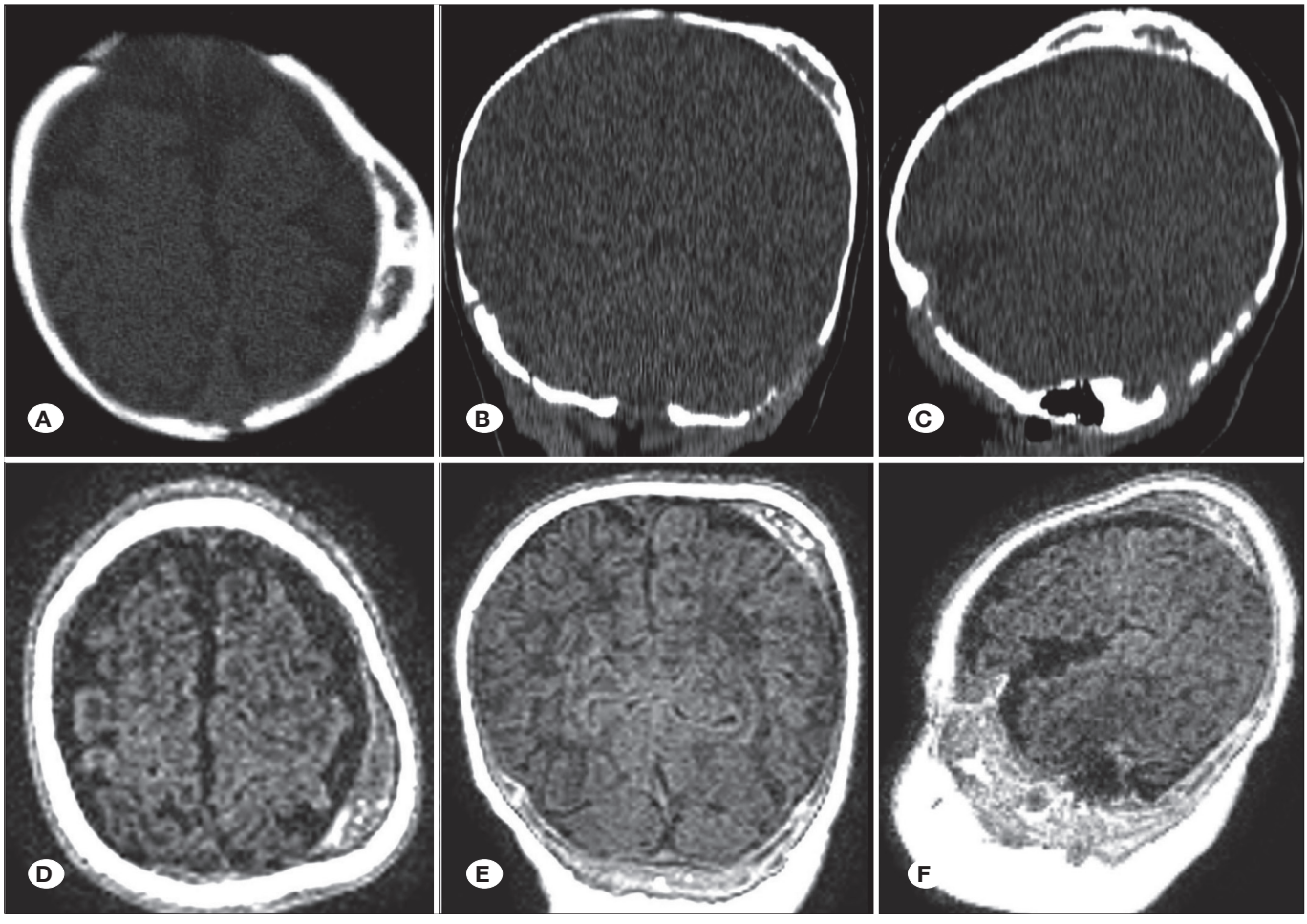

Figure 1: Case no. 1. Radiographic 'double skull' appearance of parietal Type 1 calcified cephalic hematoma (4*3 cm in diameter and 1 cm in thickness) [Brain computerized tomography (CT): **A)** axial view, **B)** coronal view, and **C)** sagittal view] and the point hyperintense appearance on T1W magnetic resonance imaging (MRI) of parietal Type 1 calcified cephalic hematoma [Brain MRI: **D)** axial, **E)** coronal, and **F)** sagittal views].

All surgeries were performed by a neurosurgeon. All patients underwent a standard surgical procedure. To prevent surgical site infections, patients were administered intravenous antibiotics (Cefazolin Na) 30 minutes before surgery. The duration of anaesthesia ranged between 45 and 75 minutes. The success of the surgery was determined based on the clinical, cosmetic, and radiologic recovery at postoperative evaluation.

This study was approved by the Ethics Committee of the Erciyes University Faculty of Medicine (2024/157). Before the study commenced, informed consent was obtained from the children's legal guardians.

Surgical Technique

The C-shaped incision was designed to be sufficiently broad to extend beyond the margins of the calcified cephalic hematoma (Figure 2A). After incision, the pericranium around the calcified cephalic hematoma was cut to create a pedicled flap and suspended using sutures or wire retractors (Figure 2B). The borders of the calcified cephalic hematoma were exposed as much as feasible, and the most prominent (higher) part of the outer layer was drilled with a high-speed drill to create a burr hole in the centre of the bulge formed by the calcified cephalic hematoma (Figure 2C). The outer layer of the calcified cephalic hematoma was excised up to the level of intact bone tissue by continuing along the edges of the burr hole with a Kerrison Rongeur to avoid injury to the cranium or dura. A curette was used to debride the hematoma remnants in the intradiploic area, and the skull (inner layer) was checked for defects (Figure 2D). The residual deformity was reshaped with a high-speed drill while utilising copious amounts of saline irrigation. During surgery, the aim was to ensure that the lateral edges of the calcified cephalic hematoma (inner layer) were lined up with the adjacent unaffected cranial bone (Figure 2E). After achieving the desired contours, the reconstructed surgical field was sealed using a pericranial flap. In some instances, the edges of the pericranial flap were trimmed to cover the defect and avoid any potential subcutaneous space. The scalp skin was sutured in layers. A drain was left from the inferolateral part of the incision (Figure 2F), and a light-pressure dressing was applied.

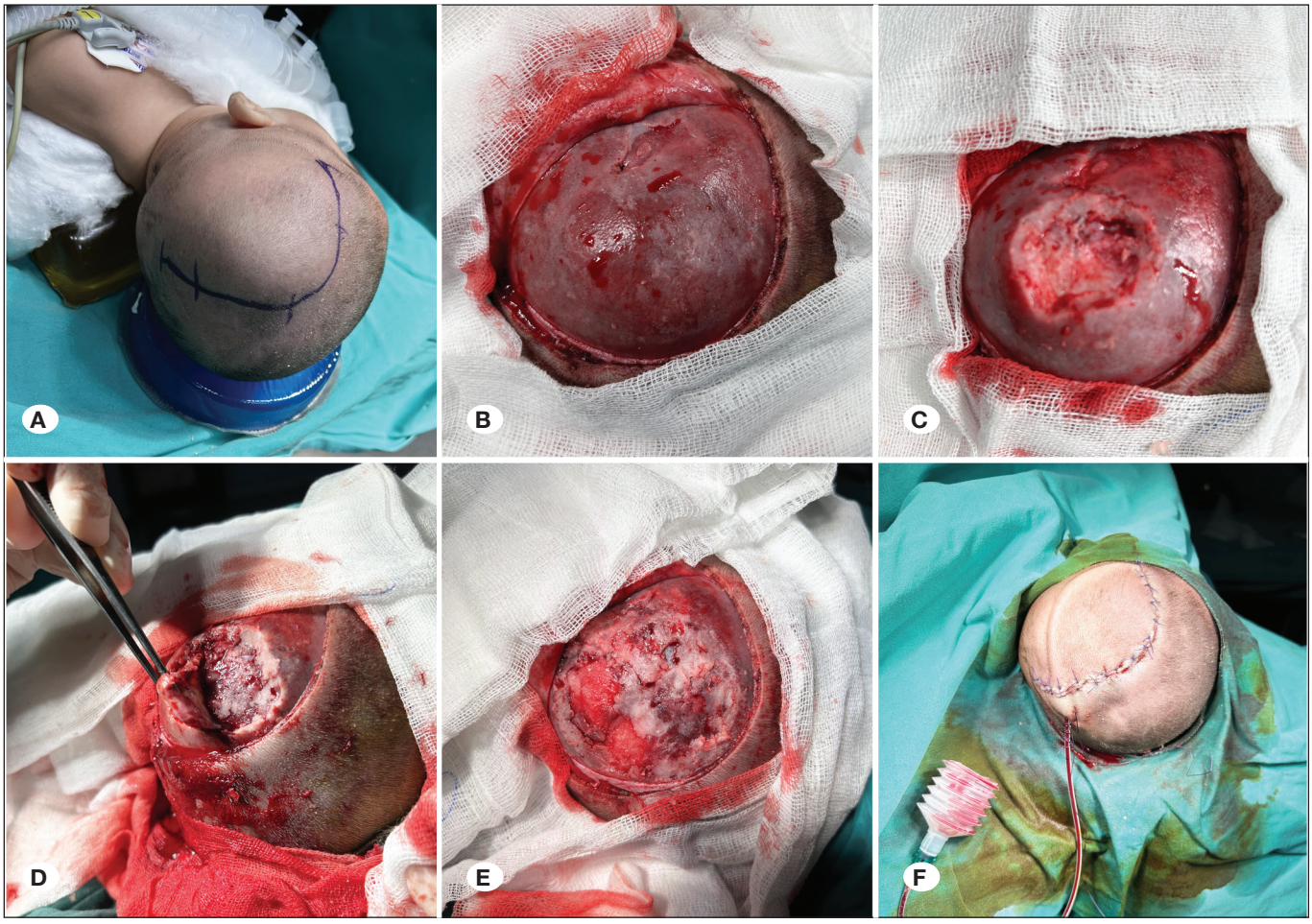

Figure 2: Surgical steps. **A)** Planned C-shaped incision, **B)** elevation of the pedicled flap to expose the surgical field, **C)** drilling of the most prominent (elevated) portion of the outer layer to create a burr hole, **D)** removal of the outer calcified layer of the cephalohematoma and remaining hematoma within the intradiploic space, **E)** alignment of the inner calcified layer of the cephalohematoma with the adjacent unaffected cranial bone, **F)** closure of the reconstructed surgical field with a pericranial flap after drain placement.

Statistical Analysis

The Statistical Package for Social Sciences version 22 software was used to analyse the study data. Frequency, percentage, mean value, standard deviation, median value and highest and lowest (min–max) values are used for expressing descriptive statistics. The Shapiro–Wilk test was used to test the normal distribution hypothesis for the study data. The Mann–Whitney U test was applied in paired groups since the independent groups of the quantitative data did not satisfy the normal distribution hypothesis. Fisher's exact test was used for statistical analysis of categorical data. A p-level of <0.05 was considered statistically significant.

RESULTS

Fifteen calcified cephalohematoma patients who underwent surgical treatment (calcified cephalohematoma excision and reconstruction) in our clinic between January 2021 and December 2023 were included in the study. Four (26.7%) patients were female, and 11 (73.3%) were male. The mean age at operation was 3.5 ± 1.9 months (min–max: 2–10). The mean follow-up period was 23.3 ± 9.5 months. Patients operated on at ages ≤3 months and >3 months were categorised into two separate groups, where ten patients (66.7%) were operated on at ≤3 months of age and five patients (33.3%) were operated on at >3 months of age. Calcified cephalic hematomas were classified into two types through a surgical approach. Regarding patients with Type 1 calcified cephalic hematoma, the contour of the skull (inner layer) was normal, whereas in Type 2 calcified cephalic hematoma patients, the skull (inner layer) was depressed (21). The number of patients with Type 1 and Type 2 calcified cephalic hematoma was 13 and 2, respectively. One patient had calcified cephalic hematomas in the occipital region, while fourteen patients had them in the parietal region (eight in the right parietal lobe, five in the left parietal lobe and one with bilateral parietal lobe lesion) (Table I). All the patients presented with complaints of scalp swelling. Every patient had a normal, spontaneous vaginal birth. Furthermore, 13 (86.7%) patients experienced difficult delivery, while two (13.3%) patients experienced postpartum trauma. None of the patients exhibited coagulopathy; one had concomitant sagittal synostosis. Three patients (20%) experienced complications (wound infection in one patient, subgaleal hematoma due to inadequate functioning of the postoperative drain in one patient, and epileptic seizure in one patient with concomitant sagittal synostosis). Bedside drainage was used to treat the patient with a subgaleal hematoma. Superficial wound infections were treated through local wound care and oral antibiotics. A paediatric neurologist was consulted before administering oral antiepileptic medication for seizures, which was stopped by the specialist when no seizures occurred throughout the 6-month follow-up. While 12 patients (80%) were discharged on the third postoperative day, three patients with complications were discharged later (one on the fifth postoperative day and two on the 7th postoperative day). There were no complications that required additional surgical intervention (revision, etc.) or hospitalisation. Five patients (33.3%) required postoperative blood transfusion, all of whom had undergone surgery within three months of their birth. Furthermore, all these patients had received a pathological diagnosis. Pathologic examination revealed haemorrhagic areas between dense fibrous connective tissue, surrounding inflammation and fibrovascular reaction, hemosiderin–laden macrophages, reactive changes and bone-containing fibrosis (Figure 3).

Analysis was done on the correlation between the number of days till the discharge date, the perioperative blood demand and specific variables (Table II and Table III). Perioperative blood requirement was significantly lower in female infants ($p<0.05$). Infants who were operated on at ≥3 months of age experienced higher follow-up times, but the difference was not statistically significant ($p>0.05$). Perioperative blood requirement was higher in infants with complications, but the difference was not significant ($p>0.05$). The number of days to discharge was significantly higher in infants with compli-

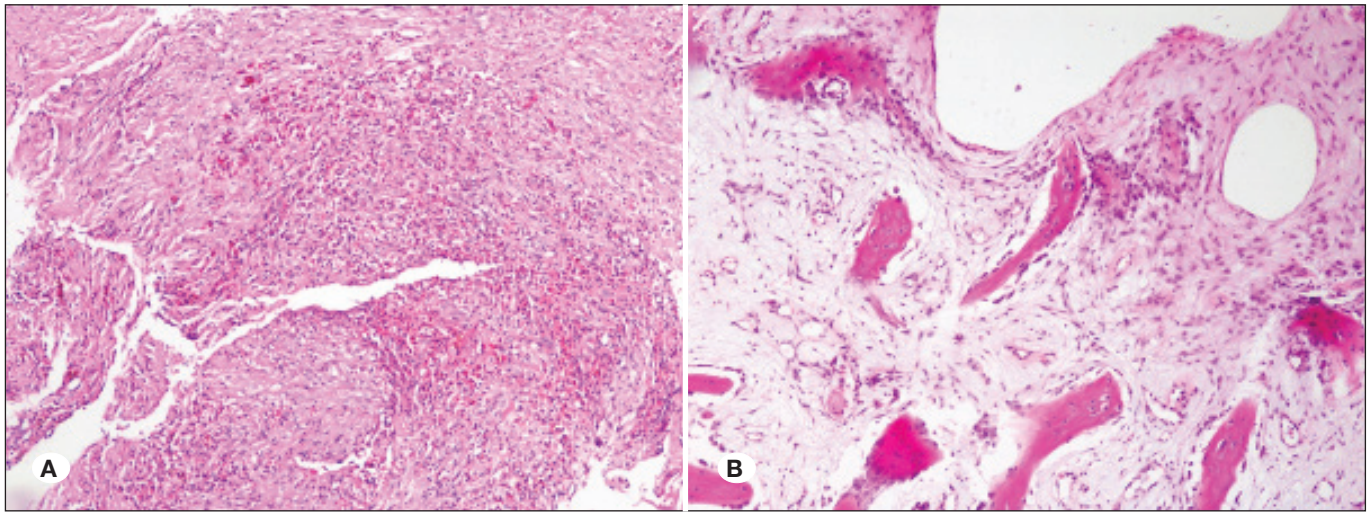

Figure 3: Hematoxylin and eosin staining (×100) of calcified cephalohematoma (Case no. 10). **A, B)** Haemorrhagic regions, hemosiderin–laden macrophages and osteoblastic activity.

Table I: Patients and Some of Their Characteristics

Cases	Variables									
	Sex	Age at the time of operation (months)	Type of hematoma	Location	Hematoma size (length-width-thickness) (cm)	Perioperative ES requirement (ml)	Postoperative ES requirement (ml)	Complication	Length of Hospital stay (days)	Follow-up period (months)
Case no. 1	Female	3	Type 1	Left Parietal	4×3×1	60	-	-	3	10
Case no. 2	Male	2	Type 2	Right Parietal	6×4×1	50	50	Wound Site Infection	7	12
Case no. 3	Male	10	Type 1	Occipital	2×3×0.5	80	-	-	3	17
Case no. 4	Male	3	Type 1	Bilateral parietal	5×3×1.5 (right) 5×4×2.5 (left)	100	50	-	3	23
Case no. 5	Female	4	Type 1	Right Parietal	3×2×1	50	-	-	3	21
Case no. 6	Male	3	Type 1	Right Parietal	3×2×1	50	-	-	3	24
Case no. 7	Male	4	Type 1	Right Parietal	2,5×3×1	70	-	-	3	30
Case no. 8	Male	4	Type 1	Left Parietal	2×3×1	50	-	-	3	33
Case no. 9	Male	3	Type 1	Left Parietal	4×3×2	50	30	-	3	36
Case no. 10	Male	3	Type 1	Right Parietal	4×3×1	50	-	-	3	32
Case no. 11	Male	4	Type 1	Left Parietal	4×3×1	100	-	Subgaleal Hematoma	5	34
Case no. 12	Female	2	Type 1	Right Parietal	3×2×1	40	-	-	3	30
Case no. 13	Female	3	Type 1	Right Parietal	3×2×1	25	-	-	3	28
Case no. 14	Male	2	Type 1	Left Parietal	5×3×2	100	50	-	3	10
Case no. 15	Male	3	Type 2	Right Parietal	4×4×1.5	100	50	Epileptic Seizure	7	10

ES: *Erythrocyte suspension.*

cations ($p<0.05$), but there was no significant difference even though the follow-up period was shorter ($p>0.05$). Perioperative blood requirement, although not statistically significant ($p>0.05$), was higher in infants with postoperative blood requirement. All patients with postoperative blood requirements were operated on at ≤3 months of age. Age at operation, sex and postoperative problems did not significantly affect the amount of blood required after surgery ($p>0.05$).

DISCUSSION

The Etiopathogenesis and Anatomical Localisation

Cephalohematomas typically occur within the first 24–72 hours after delivery and generally resolve spontaneously within the first month of life (1). In cases when the hematoma is not absorbed during this period, subperiosteal osteogenesis may take place, and new bone may grow beneath the excised pericranium (3,11). This report presents a case of a neonate diagnosed with bilateral parietal cephalohematoma on the 10th day after delivery. A follow-up brain CT scan detected a calcified cephalohematoma (Figure 4).

The aetiology of calcified cephalic hematoma may include intrauterine trauma, birth trauma and haemorrhagic disorders; occasionally no definite cause may be identified. In the present study, all the patients were born following normal vaginal delivery and did not experience any haemorrhagic disorder. Thirteen patients had a history of difficult delivery, while two patients experienced postpartum head trauma.

Table II: Perioperative ES Requirement and Length of Hospital Stay in Patients, by Certain Variables

Variables		n	Measurements			
			Perioperative ES requirement (cc)		Discharged (days)	
			Mean ± standard deviation (SD)	Median	Mean ± SD	Median
Sex	Female	4	43.75 ± 14.93	45.0	3.00 ± 0.00	3.0
	Male	11	72.73 ± 23.70	70.0	3.91 ± 1.64	3.0
	p-value		**0.048**		0.262	
Age at operation	≤3 months	10	62.50 ± 27.41	50.0	3.80 ± 1.68	3.0
	>3 months	5	70.00 ± 21.21	70.0	3.40 ± 0.89	3.0
	p-value		0.482		0.861	
Postoperative ES requirement	Yes	5	80.00 ± 27.38	100.0	4.60 ± 2.19	3.0
	No	10	57.50 ± 21.24	50.0	3.20 ± 0.63	3.0
	p-value		0.142		0.136	

ES: *Erythrocyte suspension.*

Table III: The Relationship Between Perioperative ES Requirement, Length of Hospital Stay, and Complications in Patients

Variables		n	Measurements			
			Perioperative ES requirement (cc)		Discharged (days)	
			Mean ± standard deviation (SD)	Median	Mean ± SD	Median
Complication	Yes	3	83.33 ± 28.86	100.0	6.33 ± 1.15	7.0
	No	12	60.42 ± 23.00	50.0	3.00 ± 0.00	3.0
	p-value		0.201		**<0.001**	

ES: *Erythrocyte suspension.*

Four patients were female, and eleven were male. Since there is no known difference between males and females in terms of cranial bone and diploe distance, this distribution might be coincidental considering the available information (14).

Analysis of the cephalic hematomas in the reported cases by anatomical localisation revealed that the lesions were typically located in the parietal region (14). In the present study, consistent with the previous studies, the cephalic hematomas were located in the parietal region in 14 of 15 patients and in the occipital region in one patient (Figure 5).

Clinical Findings and Postoperative Epilepsy

Calcified cephalic hematoma patients usually present with scalp swelling. Neurologic findings are not typically observed. Nevertheless, Vigo et al. reported a calcified cephalic hematoma associated with late-onset cerebral electrical anomalies with electroencephalography (EEG) discordance (20). In this study, all the patients presented with complaints of scalp swelling without abnormal EEG findings. One patient (with non-syndromic sagittal synostosis) experienced a single episode of epileptic seizure two hours following the surgery. After consulting the paediatric neurology department, oral antiepileptic treatment was initiated for the seizure. It is well-established that epileptic seizures may develop following craniosynostosis operation (16). Traumatic brain injury and metabolic or hemodynamic instability are considered the most likely causes. Our patient's EEG and control CT procedure results in the postoperative period were unremarkable. Blood parameters were indicative of hyperglycemia. It was considered that the seizure might have occurred due to the combination of two surgeries, the length of the surgical period, the high need for erythrocyte suspension (ES) replacement, hyperglycemia or hypothermia. The paediatric neurology department discontinued oral antiepileptic treatment after six months of follow-up due to the absence of recurrent seizures.

Craniosynostosis and Cephalic Hematoma

Although the pathophysiology of craniosynostosis involves multiple causes, cephalic hematoma is rarely involved. Cranial sutures restrict this condition; therefore, its lateral expansion is limited, and a secondary elevation in extracranial pressure

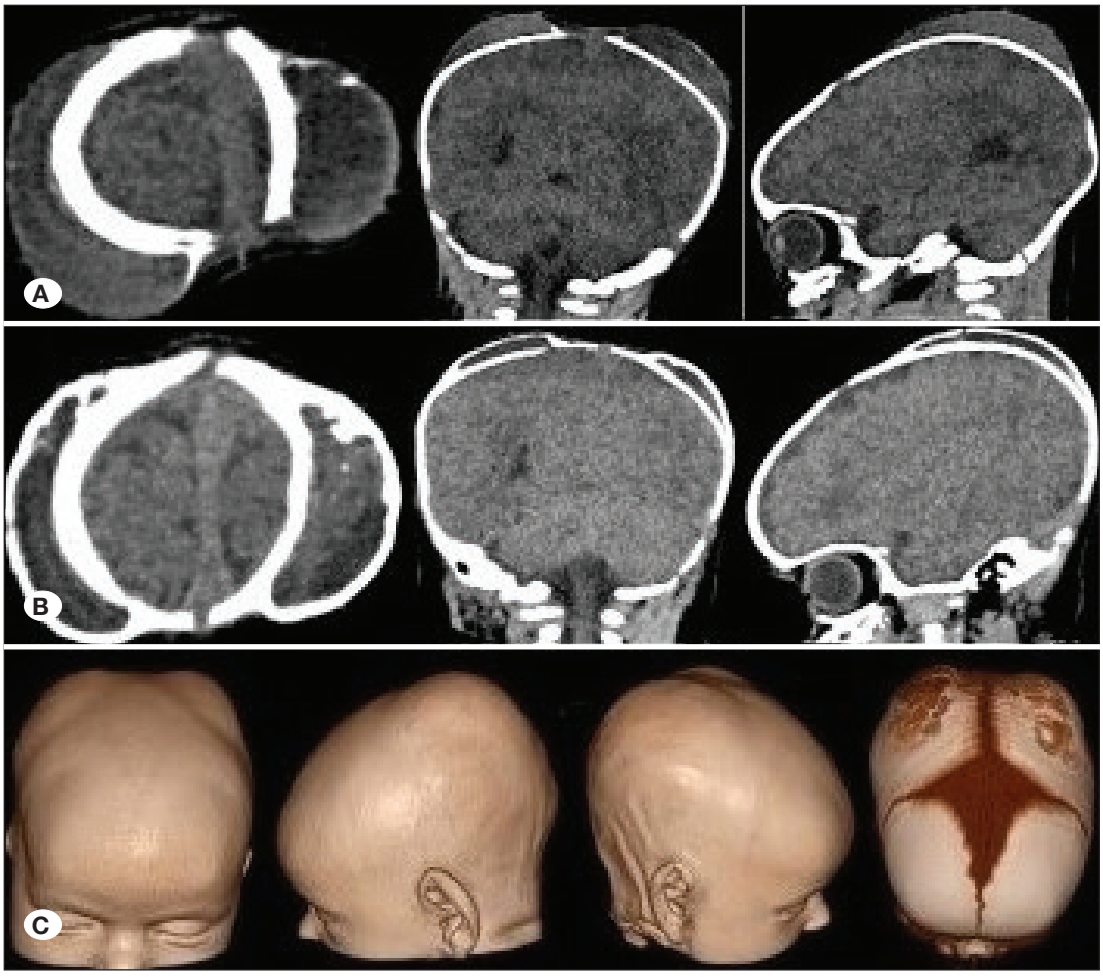

Figure 4: Case no. 4. Brain computerized tomography (CT) scans. **A)** Bilateral parietal cephalic hematoma at postnatal day 10. Axial, coronal, and sagittal views (from left to right). **B)** Bilateral parietal calcified cephalic hematoma at 3rd month: right size 5×3×1.5 cm, left size 5×4×2.5 cm. Axial, coronal and sagittal views (from left to right). **C)** Bilateral parietal calcified cephalic hematoma at 3rd month, three-dimensional views.

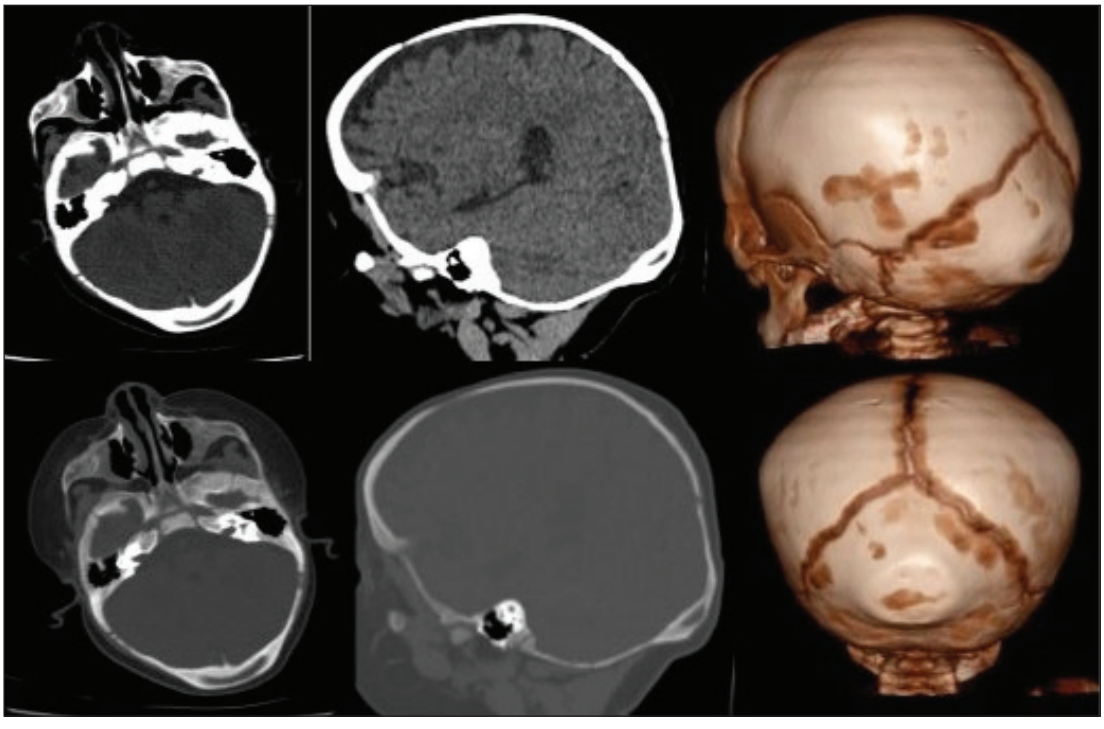

Figure 5: Case no. 3: Brain computed tomography (CT) scans of a patient with occipital calcified cephalic hematoma with dimensions of 2×3×0.5 cm.

is suggested (3,10,11,15,18). Nguyen et al. reported the successful performance of endoscopy-guided surgical treatment in their patients with sagittal synostosis and calcified cephalic hematoma (15). In the present study, a patient with non-syndromic sagittal synostosis and a calcified cephalic hematoma in the parietal region underwent suturectomy and open surgery to remove the calcified cephalic hematoma.

Radiodiagnostic Imaging

CT is widely employed to diagnose calcified cephalic hematoma and is vital in excluding other pathologies. On T1-weighted images, MRI typically displays the hematoma as hyperintense lesions and therefore has little use in highlighting bone features (20). In the present study, routine CT imaging was performed to determine the presence of calvarial defects and to accurately characterise the calcified cephalohematoma. In contrast, MRI is significantly more expensive, requires a longer acquisition time, and frequently necessitates sedation or general anaesthesia in infants. Given these disadvantages, we do not consider MRI to be absolutely necessary or routinely required for diagnosis. If parents express concerns regarding radiation exposure or if CT imaging fails to identify the relationship between the calcified cephalohematoma and intracranial structures, MRI may be considered as a viable alternative.

Differential Diagnosis: Intradiploic Hematoma and Calcified Cephalic Hematoma

Increased significance has recently been attributed to intradiploic hematoma for the differential diagnosis. Previous studies have reported sporadic cases of intradiploic hematoma (5,13,14,18). Studies also demonstrate the differences between intradiploic hematoma and calcified cephalic hematoma (5,6,8). These pathologies cannot be distinguished, and their pathogenesis is yet unclear. Differentiating calcified cephalic hematomas from intradiploic hematomas that need surgery is crucial since some of them may spontaneously resorb. Mistaking newly formed bone for the outer lamella is the primary cause of diagnostic misunderstanding. A calcified cephalohematoma is located subperiosteally, external to the calvarial bone. Gradually, the periosteum covers the hematoma, leading to the formation of a newly ossified outer layer. In calcified cephalohematoma, the inner layer originates from the calvarial bone itself (specifically, the outer table), whereas the newly ossified bone constitutes the outer layer of the calcified cephalohematoma. In contrast, an intradiploic hematoma develops within the diploe space between the inner and outer tables of the calvarial bone, where it causes a separation of these tables. The contour and thickness of the skull bone beneath the hematoma are preserved in calcified cephalic hematoma (Type 1 calcified cephalic hematoma). Even though the skull has a minor depression in Type 2 calcified cephalic hematoma cases, the thickness of the skull is mostly retained (6,21). Regarding intradiploic hematomas, their expansion–dissemination into the intracranial space is prevalent, resulting in neurologic deficits and increased intracranial pressure. The thickness of the inner and outer tables is significantly reduced. The present study diagnosed all the included patients with calcified cephalic hematoma. All the patients initially presented with a soft scalp swelling consistent with cephalohematoma, which subsequently progressed to a firm consistency, indicative of calcified cephalohematoma. Conversely, because an intradiploic hematoma develops between the inner and outer tables of the calvarial bone, the scalp swelling is expected to have a bony-hard consistency from the onset (5). In this study, no patients with intradiploic hematoma were identified.

Previous studies have documented spontaneous resolution of calcified cephalic hematomas (4,23). Nevertheless, this is exceedingly uncommon.

Indications for Surgical Treatment

Although calcified cephalic hematoma typically does not induce neurologic symptoms, surgery is indicated for cosmetic reasons due to the asymmetry of the infant's cranium (6,12). Furthermore, surgical intervention may also be recommended based on the size and morphological characteristics of the calcified cephalohematoma (19). In the present study, no patient exhibited neurological symptoms, and the only surgical indication was the presence of a calcified cephalohematoma that resulted in a significant cosmetic asymmetry of the skull along with scalp swelling. Only one patient (Case no. 3—occipital cephalohematoma) had a prominent cosmetic swelling of the scalp, despite radiological imaging showing no significant lesion. Even though early surgical intervention was not initially considered, it was decided to perform surgery because the patient frequently rested on the back of the head, leading to scalp issues in the occipital region, such as thinning and oedema. This patient, the latest to undergo surgery in this study, was operated on at ten months of age.

Timing of Surgical Treatment

The optimal timing of surgical treatment for calcified cephalohematomas is a topic of ongoing discussion. Some reports indicate that these lesions may resolve spontaneously or become less prominent relative to skull growth over time. Therefore, surgery should be performed at a later stage (after at least one year of age) (2). However, delaying surgery could cause the already fragile inner skull layer to be weakened by external pressure, leading to thinning and depression, with unknown long-term effects on brain development (21). Additionally, calcified cephalohematomas have been linked to calvarial growth abnormalities, including scaphocephaly and late-onset subclinical EEG anomalies (20,21). Compared to delayed surgery, early surgical intervention (≤3 months) may offer good cosmetic outcomes in follow-ups, with adequate calvarial reconstruction on CT scans and facilitate easier surgical management (7,9,12,22). With effective blood loss management, surgical outcomes are generally favourable (7). In a long-term retrospective study carried out by Ulma et al. involving 30 patients, five underwent surgery at or before three months of age. In these patients, the surgery was well tolerated, significant improvement in calvarial shape was observed and no revision procedures were required (19). In the present study, it was found that early surgical intervention (≤3 months) for calcified cephalohematomas posed no discernible risk in terms of haemorrhage or complications and follow-up evaluations demonstrated favourable cosmetic outcomes. Although all patients who underwent surgery within the first three months

required postoperative ES, there was no significant difference in ES requirements between patients who underwent surgery within the first three months and those who got operated on between 3 and 12 months of age. Therefore, it was concluded that calcified cephalohematomas can be safely operated on during the first three months, although blood management needs to be given extra consideration, particularly in patients with large hematomas.

Surgical Technique

Skull asymmetry can only be addressed surgically because calcified cephalic hematomas usually do not regress spontaneously. Different techniques can be employed to shape the bone flap and reconstruct the skull depending on the type of skull asymmetry (6,12,19). While simple excision of new bone formation is recommended in the surgical treatment of calcified cephalohematoma Type 1, certain authors recommend craniotomy and bone contouring for Type 2 cases (21). Each patient in this study underwent simple excision of the calcified outer layer and hematoma remnants (simple excision of the new bone) and alignment of the outer and inner layers. Additional sagittal suturectomy was performed for one patient with sagittal synostosis (Figure 6). Upon reviewing the postoperative follow-up data, including cosmetic and imaging

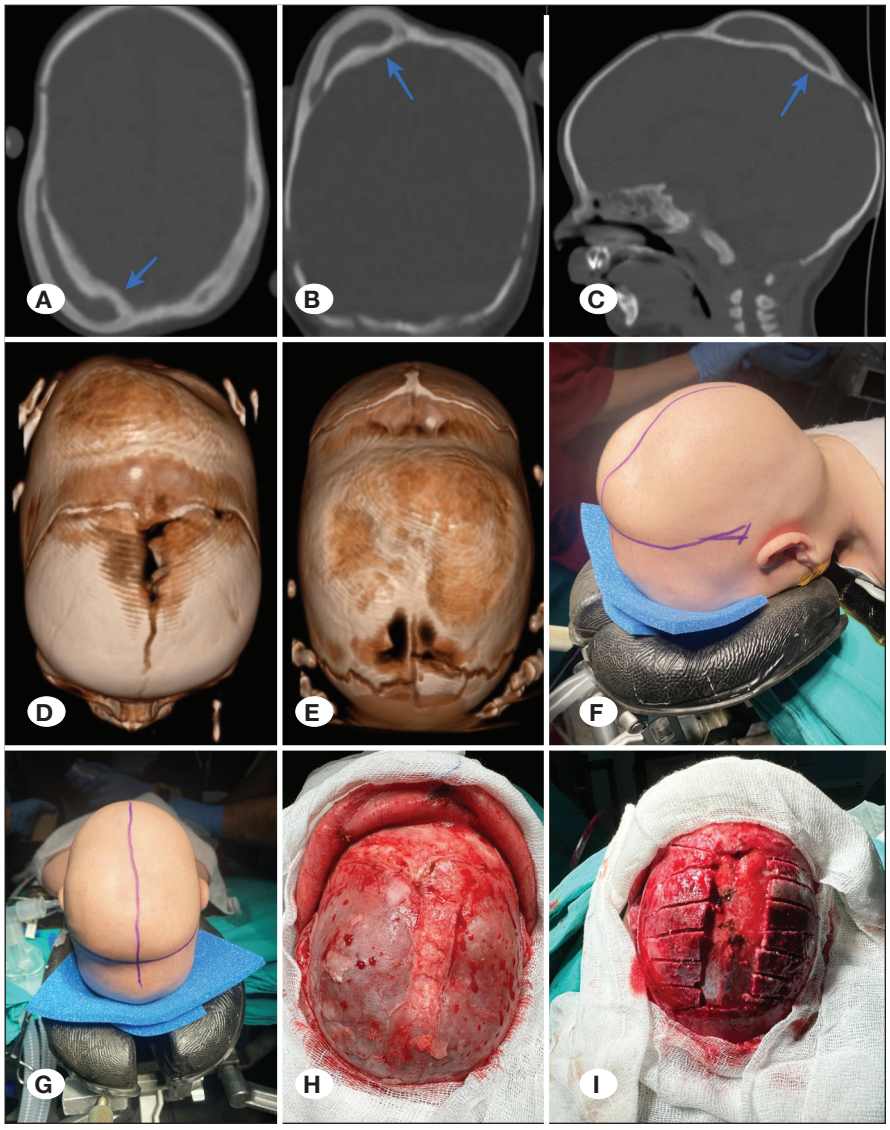

Figure 6: Case no. 15. Right parietal Type 2 calcified cephalic hematoma, which is 4x4 cm in diameter, and 1.5 cm in thickness associated with sagittal synostosis **A)** The formation of a depression in the posterior part (blue arrow) of the inner tabula, [brain computerized tomography (CT), axial view], **B)** the formation of a depression in the posterior part (blue arrow) of the inner tabula (brain CT, coronal view), **C)** the formation of a depression in the posterior part (blue arrow) of the inner tabula (brain CT, sagittal view). **D)** Three-dimensional brain CT - superior and anterior views, **E)** three-dimensional brain CT - superior and posterior views. **F)** Preoperative lateral view in the prone position, **G)** preoperative anterior view in the prone position, **H)** intraoperative view after elevation of the pericranial flap, showing the right parietal calcified cephalohematoma and sagittal synostosis, **I)** surgical field after excision of the calcified cephalohematoma and sagittal suturectomy.

assessments (CT scans), this method appears adequate and reliable for patients with Type 1 calcified cephalohematoma. Furthermore, based on the short-term outcomes of the two patients with Type 2 calcified cephalohematoma, it is believed that this surgical approach may also be beneficial for patients with mild skull depression linked to Type 2 calcified cephalohematoma. However, an extensive patient sample and long-term follow-up data might enable an estimation of more conclusive findings.

The Need for Blood Transfusion

Surgical intervention for calcified cephalohematoma may necessitate a blood transfusion. Ulma et al. reported that the risk of transfusion-requiring blood loss is higher in patients with larger or bilateral calcified cephalohematomas (19). Similarly, Xi et al. discovered that over 50% of the patients who underwent surgery required blood transfusions either during or after the procedure. It was also noted in their study that patients who required transfusion had greater hematoma volumes and were older (22). In the present study, it was observed that infants aged three months or younger required more frequent blood transfusions postoperatively. Additionally, female infants required fewer blood transfusions during the perioperative period. Factors such as the size of the calcified cephalohematomas, the dimensions of the surgical flap and the simultaneous surgical intervention for multiple calcified cephalohematomas localised in various locations may have contributed to the increased blood transfusion requirement. Nonetheless, it is believed that conducting comparative studies with alternative incision techniques, such as linear or S-shaped incisions, would be beneficial, especially with regard to their relationship with C-shaped incisions and bleeding.

Limitations

This study has certain limitations. First, the study's retrospective design can be considered a limitation. Additionally, the number of patients with Type 2 calcified cephalic hematoma was inadequate. This was yet another study limitation. Hence, prospective studies and studies with larger samples and long-term results are required to validate the findings of this study.

CONCLUSION

Calcified cephalohematoma is a rare yet serious pathologic condition that can lead to marked cranial asymmetry in infants. Surgical intervention may be considered in patients where a calcified cephalohematoma presents with scalp swelling and causes substantial asymmetry of the skull. Although various reconstructive techniques have been proposed, there is no consensus on the optimal treatment course to be adopted. The surgical technique used in this study proved to be adequate in restoring normal cranial contours, particularly in patients with Type 1 calcified cephalohematoma and those with mild cranial depression associated with Type 2 calcified cephalohematoma, while maintaining a low complication rate. It was concluded that patients with calcified cephalic hematoma could be safely operated on during the first three months following birth. Nevertheless, caution should be exercised regarding postoperative bleeding and the need for ES replacement.

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AUTHORSHIP CONTRIBUTION

Study conception and design: AS
Data collection: SO, AS, HU
Analysis and interpretation of results: AK, AS, HU
Draft manuscript preparation: AS, NAD
Critical revision of the article: AS, AK
All authors (AS, NAD, SO, HU, AK) reviewed the results and approved the final version of the manuscript.

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