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Assessment of Craniosynostosis by using MDCT among Saudi Children

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Abstract: *The main objective of the study was to assess the craniosynostosis using Multi-Detector Computed Tomography (MDCT) among Saudi pediatrics. The study was conducted in King Khalid Medical City at King Saud University in Riyadh (Kingdom Saudi Arabia) from Oct 2017 to Dec 2017. About 25 patients of age (one to 3 years) who attended to computed tomography confirmed results existence of cases, males were the number of cases, a more age group diagnosed. Results: the males were more than women, 60% of the sample were males (15) while 40% of the sample (10) were females. The number of cranial sutures affected, it says that 44% of the sample (11 patients) have only one suture, while 56 of the sample (14 patients) have more than one. This study confirmed that the Computed Tomography most accurate through the study recommended for the assessment craniosynostosis.*

Keywords: *Craniosynostosis, Suture fusion, MDCT scan, Cranial Sutures.*

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I. Introduction

Craniosynostosis is one of the pediatric diseases which are a condition of the premature fusion of one or more cranial sutures, results in characteristic cranial shape deformities and facial asymmetry accompanied by brain functional consequences such as increased intracranial pressure (ICP), visual impairment, deafness, and cognitive deficit. [1]

Normally, the sutures remain flexible and soft, giving your baby's brain time to grow until the bones fuse at about age 2. Mainly sign and symptoms of craniosynostosis are usually appearing at birth as a congenital defect, but they'll become more apparent during the first months of life. A misshapen skull, with the shape depending on which of the sutures are affected, the hard ridge along affected sutures, an abnormal feeling or disappearing fontanel on your baby's skull, development of a raised, and slow or no growth of the head as your baby grows are most common symptoms of craniosynostosis.[1]

Craniosynostosis can usually be diagnosed by a pediatrician after a visual examination of the baby's head as a clinical examination. Any severe distortions of the skull or face will be apparent, misalignment of the baby ears and the existence of ridges over fused affected sutures also provides evidence of craniosynostosis. Incomplete growth in some areas and compensatory growth in other areas will result in a change in skull shape. [1, 2]

Craniosynostosis is one of the problems that the skull trauma may cause. In this study, we assess the probability of having Craniosynostosis.and how the MDCT scan has effectiveness in detecting this problem.[3]

This study was conducted because of the inaccuracy of X-rays in diagnosing Craniosynostosis. X-rays do not show the consequences of the Craniosynostosis. Therefore, computerized tomography provides sectional images that were needed to diagnosis Craniosynostosis.[4]

For the accurate diagnosis and management of craniosynostosis, MDCT is preferred; however, the implementation of appropriate CT techniques is essential to decrease the radiation hazard in these children. [5] Multidetector Computed tomography (MDCT) has become the diagnostic modality of choice for head injuries due to its accuracy, reliability, safety, and wide availability. The changes in microcirculation, impaired auto-regulation, cerebral swelling, and axonal injury start as soon as a cranial injury occurs and manifest as clinical, biochemical, and radiological changes.[6]

II. Materials and Methods

2.1Material

2.1.1Area and duration

Retrospective Scientific Analytical study was performed in King Khalid Medical City at King Saud University in Riyadh. MDCT scan was used; the study was obtained during the period from 15 Oct to 20 December 2017.

2.1.2 Sample study

The sample of this research consisted of 25 children with Craniosynostosis. 20% of them were younger than one year, 56% of them were from one to two years and 24% of these children were older than two years. CT could diagnose all the Craniosynostosis cases.

The males were more than women, 60% of the sample were males (15) while 40% of the sample (10) were females.

Inclusion criteria: patient with craniosynostosis signs and symptoms and patient age between 1-3 years.

Exclusion criteria: patient age over 3 years.

2-2 Methods

2-2-1 Technique used

The patient's data and clinical information were obtained all the axial, coronal and sagittal images were done to identify the pathological changes as is showed in the table below which demonstrates the technique used.

Table no (1) show the MDCT scan technique used

Technical Parameters	Protocol Head Group 1	Protocol Craniosynostosis Group 2	Group 3
Tube Voltage (kVp)	80/100/120	80/100	80
mA range	150-250	50-180	50-150
Noise Index	6,5	7,28	>7,28-23,22 ($\bar{X}$=18,6)
Length of study (cm)	12,7 ± 1,3	12,3 ± 1,6	12,6 ± 0,9
Number of images	204	197	202
FOV (cm)	16	16	16
Total collimation width (mm)	40	40	40
Rotation time (s)	0,4	0,4	0,4
Pitch	0,984	0,984	0,984
Table feed per rotation	39,37	39,37	39,37
Table speed (mm)	98,4	98,4	98,4
Acquisition width (mm)	1,25	1,25	1,25
Interval (mm)	0,625	0,625	0,625
Reconstruction algorithm	Soft tissue & bone	Soft tissue & bone	Soft tissue & bone

2.2.2 Statistical analyses

By using SPSS program version16 all data and variables are analyzed. Descriptive statistics, including frequency and percentages, were calculated. ANOVA test was applied to test the significance, the *p*-value of less than 0.005 was considered to be statistically significant.

III. Results

All collected data analyzed and tabulated in tables and graphs as follows:

Table no (2) show Age distribution among a sample of the study

Age	Number	Percentage
1day –1years	5	20%
1years -2years	14	24%
Older than 2 years	6	56%
Total	25	100%

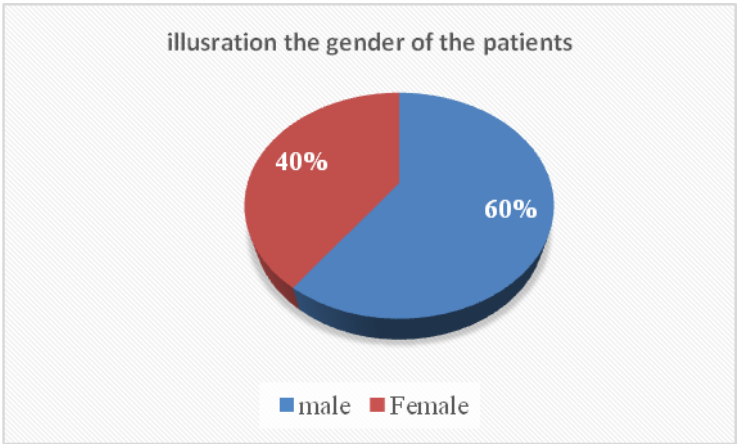

Figure no 1: a pie chart display gender distribution.

Table no (3): Number of Sutures affected

Suture affected	Number	Percentage
One	11	44%
More than one	14	56%
Total	25	100%

Table (4): show type of suture affected

Type of suture	Number	Percentage
Sagittal suture	17	68%
Coronal suture	8	32%
Total	25	100%

Table (5) Show the most complications with craniosynostosis

Complications	Number	Percentage
Increased intracranial pressure	3	12%
Asymmetry of the face	12	48%
Malocclusion	4	16%
Blindness	2	8%
Seizures	4	16%
Total	25	100%

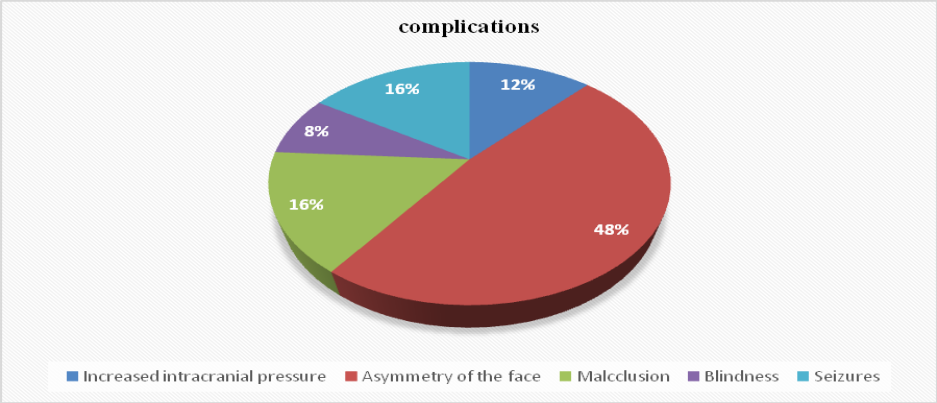

Figure no 2: a pie chart display complications of craniosynostosis

IV. Discussion

The sample of this research consisted of 25 children with Craniosynostosis. Table (2) and figure (1) show that 20% of them were younger than one year, 56% of them were from one to two years and 24% of these children were older than two years.

figure (1) shows that the males were more than women, 60% of the sample were males (15) while 40% of the sample (10) were females.

Table (3,4) shows the number of sutures affected, it says that 44% of the sample (11 patients) have only one suture, while 56 of the sample (14 patients) have more than one.

Table (5) and figure (2) shows the complications. It indicates that 3 patients (12%) had an increased intracranial pressure, while 48% of the patients (12 patients) had an asymmetry of the face. 4 patients (16%) had malocclusion, while only 2 patients (8%) had blindness, and the last 4 patients (16%) had seizures.

Comparing these result with Hyun Jeong Kim, Craniosynostosis :demonstrate Updates in Radiologic Diagnosis which his results concluded 3-D CT has superior diagnostic value, concerns about the hazards of radiation exposure in children has led to a consensus to avoid or postpone radiographic CT imaging until the end of the first year of life or as late as possible in children with suspected or diagnosed craniosynostosis.[7]

Other results were Chaitra A. Badve Craniosynostosis imaging review and primer on computed tomography his evaluation with 3-D CT plays an important role in accurate diagnosis and management; however, implementation of appropriate CT techniques is essential to limit the radiation burden in these children.[8,9]

From a clinical perspective, the studies reviewed suggest that the outcomes of most children with isolated craniosynostosis (slightly more than half) are indistinguishable from those of typical children. However, a sizable minority (perhaps 30% to 40%) is likely to have problems in need of intervention. This tentative estimate of risk suggests that routine neurodevelopmental screening and referral would benefit children with synostosis, especially preschool-age children for whom the benefits of early assessment and intervention have been well demonstrated. [9]

Rapid scanning with 64-slice multidetector scanners minimizes image degradation from patient movement; in select cases, however, patients may have to be sedated. 3D-CT allows for exquisite assessment of the vault and skull base in addition to an assessment of secondary changes of craniosynostosis in the cranial fossae, orbits and facial bones.this was a result of Paritosh C Khanna. [10]

Similar result with the Result of 33 pediatric patients, 21 had craniosynostosis (39 positive sutures and 225 negative sutures). The mean volume CT dose index was 15.5 ± 2.3 mGy (range, 9.69–19.38 mGy) for the routine dose examination. Concluded that For pediatric head CT for evaluation of craniosynostosis, dose reductions of 75%–90% were possible without compromising observer performance and Average of CT performance was higher than conventional images because of using 2D and 3D images together and reconstruction technique in MDCT scan.[11,12]

V. Conclusion

The results of this research were as expected. It appears that MDCT is the best test that can be done to diagnose Craniosynostosis. In this study, the CT could find the Craniosynostosis in all the cases. Therefore it is an accurate and fast device in finding Craniosynostosis and protocol 3D. [13, 14] The most important result that the number of cranial sutures affected, it says that 44% of the sample and girls are higher ratio compared with boys. Because of the accurate and effective reconstruction technique that is provided in MDCT, MDCT is the modality of choice to detect and evaluate craniosynostosis.

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