



A Prospective Study on Computed Tomography Scans of Brain among Children

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Abstract

Background: Computed tomography (CT) scans forms the advanced imaging technique which has a high diagnosed yield. The anatomical details of the structure viewed are given in great detail. These properties made them the most used advanced imaging procedure

Methods: In total, thirty-five children of age less than twelve years and greater than two year of age requiring CT scan of the brain comprised the study group. The children with nil paternal consent and contraindications of CT scan such as had taken a CT within one year and precancerous conditions were excluded from the study. Chloral hydrate and diazepam was used for sedation during the procedure

Results: Among the 35 patients studied, five patients had abnormal CT scans. Seven (20%) patients didn't respond to chloral hydrate and was given diazepam for sedation. Mass lesion was found in three patients (8.57%).

Discussion: The diagnostic yield of epilepsy syndromes is increased when there is suspected localizing signs in physical examination. Altered intra-cranial pressure was associated with the CT finding like radio-opacity in the sub-arachnoid space, basal cistern morphological changes, extra-axial mass lesion.

Conclusion: Emergency CT brain scans done are more when compared to elective CT scans. One fifth of the patients didn't respond to oral chloral hydrate sedation.

Keywords: Computed tomogram, indications, children, neurological diseases.

Introduction

Computed tomography (CT) scans forms the advanced imaging technique which has a high diagnosed yield. The anatomical details of the structure viewed are given in great detail. These properties made them the most used advanced imaging procedure. On the other hand, brain is the

most complex organ in the body and can only be viewed by these highly sophisticated techniques⁽¹⁾. Though it said be a better procedure, it has limitations such as high dose radiation exposure, adverse reactions to the contrast agents and poor yield of the soft tissue diseases. However, intracranial haemorrhaging conditions like dural

hematomas, subdural and parenchymal haemorrhage with the calcifying condition involving the brain like neurocysticercosis and mass lesions with or without atrophy of the parenchyma can be elucidated in the plain CT scan⁽²⁾. CT brain is the investigation of choice when intra-cranial bleeding is suspected. When there is no suspected history of trauma, especially in non-accidental head injury causing subdural haemorrhage, CT brain scan helps in diagnosis the lesion⁽³⁾. Possibility of the intra-cranial injury in patients with mild head injury can be ruled out with no findings in physical examination alone⁽⁴⁾. Potential radiation dose hazard exist if it is used frequently. Local dose reference values allows optimal dosage for the better visualization of the organs^(5,6).

Methods

The study was conducted prospectively in Paediatric wards, Intensive care unit and casualty, Department of Paediatrics, Rajah Muthiah Medical College and Hospital, Chidambaram from September 2017 to October 2018. In total, thirty-five children of age less than twelve years and greater than two year of age requiring plain CT scan of the brain comprised the study group. The children with nil paternal consent and contraindications of CT scan such as had taken a CT within one year and precancerous conditions like xeroderma pigmentosa, ataxia telangiectasia, oculo-cutaneous albinism were excluded from the study. Demographic details, mode of CT done, diagnosis, either done electively or emergency and impression of the CT scan were noted. The patients were imaged using a recently calibrated 4

slice CT scanner. Data were stored confidentially with supervision. Chloral hydrate and diazepam was used for sedation during the procedure. Children were followed throughout the entire course of stay. Specific treatment for the diagnoses was given as per the protocol followed in the hospital. Data was analysed by descriptive statistics function in the Microsoft Excel 2010.

Results

Among the 35 patients studied, five patients had abnormal CT scans. Self-fall (n=12), generalised seizure (n=3), road traffic accident (n=12), headache (n=1), foot drop (n=1) and altered sensorium/? Meningitis (n=1) were the patients had normal study. Road traffic accident (n=1), another road traffic accident (n=1), development delay (n=1), focal seizure (n=1), altered sensorium/? Meningitis (n=1) had subdural hematoma, subdural haemorrhage with depressed fracture, diffuse cerebral atrophy, diffuse cerebral atrophy and diffuse cerebral oedema respectively. Chloral hydrate was used initially for sedation in all the children. Seven (20%) patients didn't respond to chloral hydrate and was given diazepam for sedation. Mass lesion was found in three patients (8.57%). One patient aged six years with subdural hematoma had 8x2 mm hyperdense biconvex lesion in the right parietal region. Another patient aged twelve years with subdural haemorrhage due to depressed fracture over the right frontal region had hyperdense biconvex lesion 21x7 mm. the inner and outer table of the frontal bone was broken on the right side. The other patient had hypodense lesion in the left parietal region 35x16 mm.

Table-1: Demographic details

Age (years)	Number (n)	Percentage (%)
Toddlers	7	20.00
Pre-school children	12	34.29
School going children	16	45.71
Sex	Number (n)	Percentage (%)
Male	18	51.43
Female	17	48.57
Total	35	100

S. No.	Mode of CT done	Indication	Number (n)	Percentage (%)
1	Emergency	Altered sensorium / ?meningitis	2	5.71
		Road traffic accident	14	40.00
		Self-fall	12	34.29
2	Elective	Developmental delay	1	2.86
		Foot drop	1	2.86
		Headache	1	2.86
		Seizure	1	2.86
Total			35	100

S.No.	CT Findings	Number (n)	Percentage (%)
1	Normal study	30	85.71
2	Diffuse cerebral atrophy	2	5.71
3	Diffuse cerebral oedema	1	2.86
4	Subdural hematoma	1	2.86
5	Subdural haemorrhage with depressed fracture	1	2.86
Total		35	100

Discussion

The diagnostic yield of epilepsy syndromes is increased when there is suspected localizing signs in physical examination. They have generalized or focal mass lesions or atrophy of the brain. However, abnormal scans were also seen in one thirds of the patient⁽⁷⁾. Serial CT scans were used in parenchymal emphyema of the brain where the lesions in the CT taken before antibiotic given compared with that after the treatment. When compared with the neuro-physical examination which varies frequently while healing following antibiotic treatment, the CT scan of the brain can be used to confirm that the infective focus in the brain is cleared following the antibiotic therapy⁽⁸⁾. Procedural sedation during the scanning period decreases the anomalous appearance in the scans. In this study, chloral hydrate was used initially for procedural sedation. If there is no response to the chloral hydrate, then diazepam is used. Altered intra-cranial pressure was associated with the CT finding like radio-opacity in the sub-arachnoid space, basal cistern morphological changes, extra-axial mass lesion⁽⁹⁾. Reduced radiation dose with image enhancing programs make the images equivalent to the standardized CT scans in the school going children but the quality is much reduced in the toddlers and pre-school children especially images of the lower brain probably due

to poor penetration^(10,11). For extra-cranial lesions, screening with specialized questionnaire may decrease the usage of routine CT brain scans especially in the peri-orbital cellulitis⁽¹²⁾.

Conclusion

Emergency CT brain scans done are more when compared to elective CT scans. One fifth of the patients did not respond to oral chloral hydrate sedation.

References

1. Oakley E, May R, Hoepfner T, Sinn K, Furyk J, Craig S, et al. Computed tomography for head injuries in children: Change in Australian usage rates over time. *Emerg Med Australas.* 2017 Apr;29(2):192–7.
2. Amaranath JE, Ramanan M, Reagh J, Saekang E, Prasad N, Chaseling R, et al. Epidemiology of traumatic head injury from a major paediatric trauma centre in New South Wales, Australia. *ANZ J Surg.* 2014 Jun;84(6):424–8.
3. Hoskote A, Richards P, Anslow P, McShane T. Subdural haematoma and non-accidental head injury in children. *Childs Nerv Syst.* 2002 Jul;18(6–7):311–7.

4. Farizal F, Mohd Haspani MS. Mild paediatric head injury: the diagnostic value of physical examinations compared with computed tomographic scans. *Malays J Med Sci.* 2012 Jul;19(3):64–8.
5. Brady Z, Ramanauskas F, Cain TM, Johnston PN. Assessment of paediatric CT dose indicators for the purpose of optimisation. *Br J Radiol.* 2012 Nov;85(1019):1488–98.
6. Wong S-T, Yiu G, Poon Y-M, Yuen M-K, Fong D. Reducing radiation exposure from computed tomography of the brain in children--report of a practical approach. *Childs Nerv Syst.* 2012 May 12;28(5):681–9.
7. Galas-Zgorzalewicz B, Godlewski A. Computerized tomography brain scanning in the diagnosis of partial epilepsy in children. *Acta Med Pol.* 1989;30(1–2):83–91.
8. Nayan SAM, Abdullah MS, Naing NN, Haspani MSM, Md Ralib AR. Correlations between subdural empyema and paraclinical as well as clinical parameters amongst urban malay paediatric patients. *Malays J Med Sci.* 2008 Oct;15(4):19–27.
9. Young AMH, Donnelly J, Liu X, Guilfoyle MR, Carew M, Cabeleira M, et al. Computed Tomography Indicators of Deranged Intracranial Physiology in Paediatric Traumatic Brain Injury. *Acta Neurochir Suppl.* 2018;126:29–34.
10. Ledenius K, Stålhammar F, Wiklund LM, Fredriksson C, Forsberg A, Thilander-Klang A. Evaluation of image-enhanced paediatric computed tomography brain examinations. *Radiat Prot Dosimetry.* 2010 Apr 1;139(1–3):287–92.
11. Pace E, Borg M. Optimisation of a paediatric ct brain protocol: a figure-of-merit approach. *Radiat Prot Dosimetry.* 2018 May 18;
12. Crosbie RA, Nairn J, Kubba H. Management of paediatric periorbital cellulitis: Our experience of 243 children managed according to a standardised protocol 2012-2015. *Int J Pediatr Otorhinolaryngol.* 2016 Aug;87:134–8.