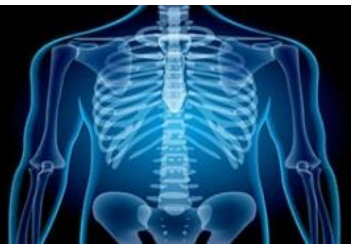
International Journal of Radiology and Diagnostic Imaging



E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2020; 3(1): 299-301
Received: 03-11-2019
Accepted: 10-12-2019

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A study on radiological evaluation on spinal dysraphism

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DOI: http://dx.doi.org/10.33545/26644436.2020.v3.i1d.375

Abstract
Background: Spinal dysraphism (SD) are a heterogeneous group of disorders arising due to incomplete fusion of the dorsal aspects of spine and spinal cord. Radiological evaluation using MRI and Helical CT aids in assessing the type of defect and plan for the treatment
Materials and Methodology: A total of 50 patients with spinal dysraphisms who were referred to the Department of Radiology, Kamineni Academy of Medical Sciences and Research Centre, LB Nagar over a period of 18 months, i.e. May 2018 to October 2019 were included in the study
Results: Most of the study subjects were females. Majority of the patients were aged between 1-5 years. Swelling over lower back is the most common presenting complaint. Open spinal dysraphisms were more common than closed SDs. Myelomeningocele was the most common observed SD and most common open SD. Spinal Lipoma was the most common closed SD.
Conclusion: Helical CT scan and MRI are the imaging modalities of choice in evaluation of spinal dysraphism. MRI is useful in imaging of the neural structures and Helical CT is useful in evaluation of bony abnormalities of the spine.

Keywords: Spinal dysraphism, neural tube defects, helical CT, MRI, neuro-imaging, myelomeningocele

Introduction
The word *dysraphism* is derived from Greek words "*dys"* and "*raphe"* which mean bad and suture respectively. Spinal dysraphisms (SD) are a group of congenital malformations of the spine and spinal cord. These are a subtype of neural tube defects and have an estimated prevalence of 1-3 per 1000 live births. Lumbosacral spine is the most commonly involved site in 90% of the cases, followed by thoracic spine and cervical spine [1-2].
Genetic factors, peri-conceptional factors and environmental factors have a pivotal role to play in the development of spinal cord defects. Maternal factors like maternal obesity, smoking, sedentary lifestyle, poor nutrition, tobacco exposure and mental stress have a central role in this process. Some studies have suggested intake of folic acid in prevention of neural tube defects. Folic acid is a vitamin essential in the metabolism of homocysteine [4-6].
Spinal dysraphisms are categorized into two types- open SD's and closed SD's, depending upon the presence of abnormality of the overlying skin. Open SD's do not have any overlying skin covering the defect and hence expose the neural tissue and meninges. In closed SD's, the neural tissue and meninges are covered by skin or sub-cutaneous tissue. Closed SD's are subdivided into those with a subcutaneous mass and those without a subcutaneous mass [7].
Helical Ct scan and MRI of brain and spine are useful in evaluation of SD's. A detailed knowledge of spinal anatomy is required for early identification of this condition.
This study aims to evaluate the role of helical CT & MRI in spinal dysraphisms.

Materials and Methodology
This prospective observational study was done in the Department of Radiology, Kamineni Academy of Medical Sciences and Research Centre, LB Nagar over a period of 18 months, i.e. from May 2018 to October 2019.
Inclusion criteria:
- Patients presenting with open SD's.
- Who have lumbosacral swelling.

- Who have tuft of hair / dimple over lumbosacral region.
- Who have vertebral anomalies on plain X-ray of LS-spine.
- Those who have bladder/ bowel incontinence since childhood.
- Who have motor or sensory deficits since childhood or
- Who have congenital scoliosis/kyphosis / kyphoscoliosis.

Patients who were already treated for SD's or patients with spinal tumours or with any spinal infections were excluded from the study.

A written informed consent was taken from all the patients and guardians (If the patient is of pediatric age group or if the patient is not in a sane state of mind) prior to start of the study. All patients were screened for any implants / clips/ cochlear implants etc. MRI was done using GE 1.5 Tesla MR system. Sagittal, fast spin echo T1-W and T2-W images were taken. Axial T1-W and T2-W images were taken in abnormal areas. Most of the children required sedation during MRI scan.

Helical CT was done using multi-slice CT scan system.

Ethical committee approval was taken prior to start of the study.

Results

A total of 50 patients with spinal dysraphisms were included in the study. 76% of them were females, with female to male ratio being 2.3: 1. Open SDs (n=28) constituted 56% of the total cases and closed / occult SDs (n = 22; 44%).

Table 1: Age-wise distribution

Age in years	No of patients	No of males	No of females
0 – 1 year	12 (24%)	3	9
1 – 5 years	22 (44%)	5	17
>5 years	16 (32%)	4	12
Total	50	12	38

Table 2: Clinical presentation

Symptom	No. of patients
Swelling over lower back	25 (50%)
Tuft of hair	2 (4%)
Sacral dimple	2 (4%)
Motor or sensory deficit of limbs	5 (10%)
Urinary incontinence	14 (28%)
Dermal sinus	1 (2%)
Capillary hemangioma	1 (2%)

Most common clinical presentation was presence of swelling over lower back (50%), followed by urinary incontinence (28%).

Table 3: Site involved

Site	No. of patients
Lumbosacral spine	43 (86%)
Thoracic spine	6 (12%)
Cervical spine	1 (2%)

Lumbosacral spine was the most commonly involved site (86%), followed by the thoracic spine. 72% of the SDs were of open type and the rest 28% were of the closed type. Amongst the open type of SDs, myelomeningocele was the most common type of SD. Spinal Lipoma was the most common type of closed spinal dysraphism.

Table 4: Type of spinal dysraphism

Open spinal dysraphism (n= 36; 72%)		Closed spinal dysraphism (n = 14; 28%)	
Type	**Total no. of patients**	**Type**	**Total no. of patients**
Myelocele	4 (8%)	Spina bifida	1
Meningocele	1 (2%)	Diastematomyelia	2
Myelomeningocele	31 (62%)	Sacral agenesis	1
		Dorsal dermal sinus	1
		Tight filum terminale	1
		Spinal Lipoma	8

Discussion

Spinal dysraphism is a constellation of condition caused due to incomplete closure of dorsal midline bones of vertebra, neural tissue of spine and skin and subcutaneous tissue.

Plain radiograph is not good enough in the evaluation of the posterior elements of spine. MRI is excellent in characterizing the soft tissue spinal anomalies of spinal dysraphism multi-planar reformatted CT is an excellent imaging modality for characterization of vertebral bony anomalies like spina bifida, hemi-vertebra, butterfly vertebra, block vertebra, coronal cleft etc. This study was done to evaluate the clinico-radiological features of patients presenting with spinal dysraphism.

A total of 50 patients with spinal dysraphism were studied in a span of 18 months. Most of the patients were females. Irwin *et al*. 7[], Kumaran *et al*. [8] and Hosagavi *et al*. [9] also had reported a strong female preponderance in their respective studies.

Most of the patients in present study were between 1-5 years (44%) with age ranging from 5 months to 15 years. similar distribution of age was seen in study done by Kumari MV *et al*. [10]. Nafees M *et al*. [11] had most of their study patients below 1 year of age.

Most common presentation was swelling over lower back, followed by urinary incontinence. Hosagavi *et al*. [9] also had similar observation in their study.

Most common site of SDs are lumbosacral spine (86%), followed by thoracic spine which is in concordance with studies by Kumari MV *et al*. [10] (52.6%) and Nafees M *et al*. [11] (51.4%).

In present study, out of 50 patients, 36 had open SDs and the rest 14 had occult / closed SDs. However, Hosagavi *et al*. [9] and Kumari MV *et al*. [10] had observed higher incidence of closed SDs in their study.

Myelomeningocele is the most common type of SDs observed in present study (62%). Kumari MV *et al*. [10] (57.5%) and Nafees M *et al*. [11] (39.2%) also had Myelomeningocele as the most common SDs.
Among closed SDs, spinal Lipoma was the most common. This is in accordance with studies by Kumaran *et al*. [8] and Hosagavi *et al*. [9].

Conclusion
Neuroimaging of neural tube defects has a central role in diagnosis of such condition. Defects of spine and spinal cord require a thorough knowledge of the spinal anatomy. Emphasis should be laid on early detection of these anomalies during antenatal scans. By doing so, the attending physician can counsel the future parents regarding the prognosis of the defect and take necessary steps wherever required.

Acknowledgement: The authors would like to thank the entire staff at Department of Radiology for providing their valuable support in conducting this study

Conflicts of interest: Nil

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