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MRI In Evaluation of Suspected Spinal Dysraphism

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Abstract

Background: Spinal dysraphism includes spectrum of congenital fusion anomalies of one or more dorsal midline structures including skin, subcutaneous tissue, vertebrae, meninges and neural tissue. It is due to incomplete midline closure of the bony and neural spinal tissues. Magnetic resonance imaging (MRI) is now considered to be the imaging modality of choice.

Aims & objectives

1. To assess the role of MRI in the evaluation of suspected spinal dysraphism.
2. To assess the spectrum of lesions of spinal dysraphism.

Methodology: This study included 30 Patients suspected of spinal dysraphism, referred to Department of Radiodiagnosis Basaweshwara Teaching and General Hospital attached to Mahadevappa Rampure Medical College, over a period of 16 months were subjected to MRI using 1.5 T Philips Achieva MRI machine.

Results: In our study, of the 30 patients; 20 (66.6%) were of open spinal dysraphisms and 10 (33.3%) of closed dysraphisms. Among different types of dysraphism Myelomeningocele is the commonest and constituted 17 cases (85%) of all open dysraphism and lumbosacral region is the commonest location, which constituted 17 (56.6%).

Conclusion: MRI with its multiplanar capabilities and superior soft tissue contrast, allows detection of detailed anatomy and characterization of congenital spinal disorders. An organized approach and MRI can helps in making the correct diagnosis as it does not involve ionizing radiation, is advanced and safe modality for assessing the spinal cord at all ages and defining complex spinal dysraphism.

Keywords: Magnetic Resonance (MRI), Spinal Dysraphism.

Introduction

Spinal dysraphism includes spectrum of congenital fusion anomalies of one or more dorsal midline structures including osseous, mesenchymal and nervous tissue.[1]

Early imaging approaches were based on the use of conventional Radiography, Ultrasonography (USG) and Computerized tomography (CT). Spinal dysraphism is one of the most common congenital disorders associated with significant mortality and morbidity. The estimated incidence of spinal dysraphism is about 1–3/1000 live births[2]. About 55-70% of neural tube defects occur in females. Variations in prevalence based on race, ethnicity, gender and region have also been reported. The prevalence of neural tube defects (including anencephaly and spinal dysraphisms) has been on the decline during the last 25 years as a result of antenatal screening and folic acid supplementation. Majority of the closed spinal dysraphic states are asymptomatic at birth. They are suspected in the presence of high-risk cutaneous markers, or when these children present with neurological deficit later in life.

MRI is the assessment of choice because of its better investigative performance, exceptional soft tissue characterization and importance in presurgical planning[3]. MRI is the imaging modality of choice in the diagnosis and characterization of spinal dysraphism. Rest of the modalities play a supplemental role. Antero-posterior and lateral plain radiographs are a must for evaluation of the vertebral column.

In cases of diastematomyelia, bony spur may be seen. Radiographs are used as screening examinations to guide the further imaging work-up. Ultrasonography is useful in the antenatal diagnosis of spinal dysraphism and is also of some use in the neonate and infant. During the first year of life it becomes progressively less useful as ossification of posterior elements proceeds. Prenatal ultrasonography can detect the open widened neural arch, with flared laminae, can show the meningomyelocele sac and detect hydrocephalus and associated cranial anomalies. Direct ultrasonography of the sac in children using high frequency transducers gives information about the contents of the sac. But, for complete and detailed information, an MRI scan is often required[4]. In cases of split cord malformation, CT is useful in demonstration of the bony spur. Prior to the advent of MRI, myelography and post-myelogram CT were used. MRI gives a non-invasive and accurate method to evaluate spinal dysraphism, thus making it the modality of choice. The excellent contrast resolution, wide field of view and multiplanar images help evaluate the entire spinal cord, contents of the back mass; detect cord tethering, associated syringomyelia. For the demonstration of syrinx and associated pathologies like dermoid and epidermoid cyst, T2W images are helpful . Patients with spinal dysraphism can have multiple spinal anomalies. For example, a patient with myelomeningocele may have associated chiari malformation or syringohydromyelia. Fetal MRI may be used as complimentary modality to USG for the antenatal diagnosis of spinal anomalies and associated hydrocephalus.

Methodology

This study on "**MRI In Evaluation of Suspected Spinal Dyspharism**" has been carried out in Department of Radio-diagnosis, Mahadevappa Rampure Medical College, Kalaburagi. A total number of 30 patients suspected of spinal dysraphism, of age till 25 years and either sex referred to Department of Radiodiagnosis over a period of 16 months i.e. between

1st March 2022 to 31st December 2022 were included in this study.The study protocol was approved by the ethical committee. All guardians of neonates and paediatric patients were explained of the procedure and informed consent was taken from them. All patients were scanned during natural sleep.

MRI was performed on a PHILIPS ACHIEVA 1.5T MR system. The standard spine imaging included sagittal, fast spin-echo T1, T2-w (weighted) and STIR sequences both axial T1-W and T2-W images were acquired.

Inclusion Criteria

All patients till 25years of age suspected to have spinal dysraphism.

Exclusion Criteria

Patients with anencephaly, physical abnormality caused due to spinal neoplasms, Friedreich's ataxia, cerebral palsy, old poliomyelitis and local conditions of the feet.

Results

of the 30 patients who underwent MRI during the study

- Open spinal dysraphism was more prominent than closed type, accounting for 20 out of 30 patients.
- Lumbo-sacral region was the most common location for spinal dysraphism, followed by lumbar and dorsal.
- Lumbo-sacral Meningomyelocele was the most common type of open spinal dysraphism accounting for 17 cases approximately 85%
- Closed Spinal dysraphism without subcutaneous mass were more common than with subcutaneous mass, which consisted of dorsal dermal sinus, hemi vertebrae. Other closed spinal dysraphism with subcutaneous mass were Meningocele, lipomyelocele.

Results

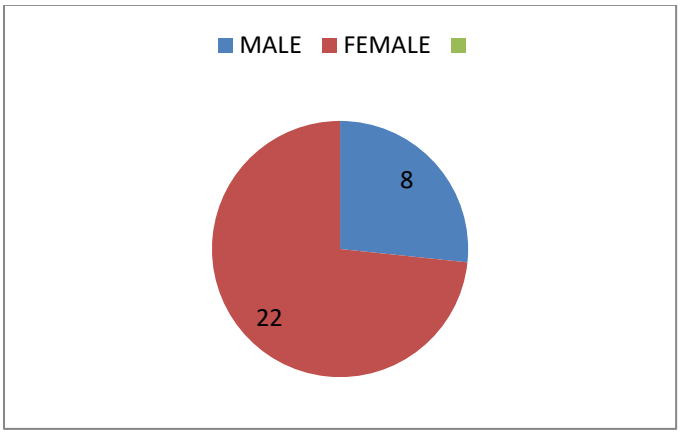
In the present study of Spinal Dysraphism in 30 patients during the study period, following are the results:

Distribution of study subjects according to gender

Table 1: showing distribution of gender in study subjects.

Gender	Number	Percentage
Male	8	27%
Female	22	73.30%

Chart 1: Pie chart showing distribution of gender in study subjects



In our study ,of 30 patients 22{73.3%} were female and 8{ 27%} were male patients .

2.Age wise distribution of study subjects

Table 2: showing age wise distribution of study subjects

	Age in days				
	<1 month	1m to 1yr	1yr to 5yr	5yr to 25yr	Total
Male	6	1	0	1	8
Female	13	5	2	2	22
	19	6	2	3	30

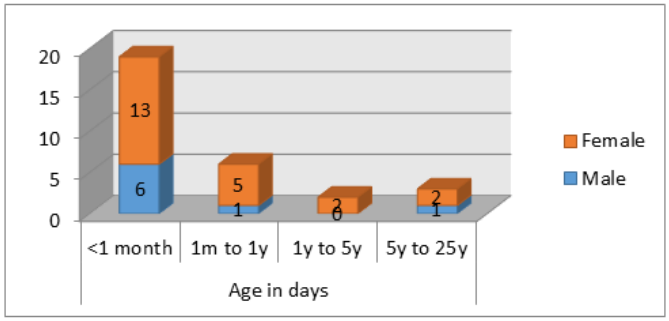


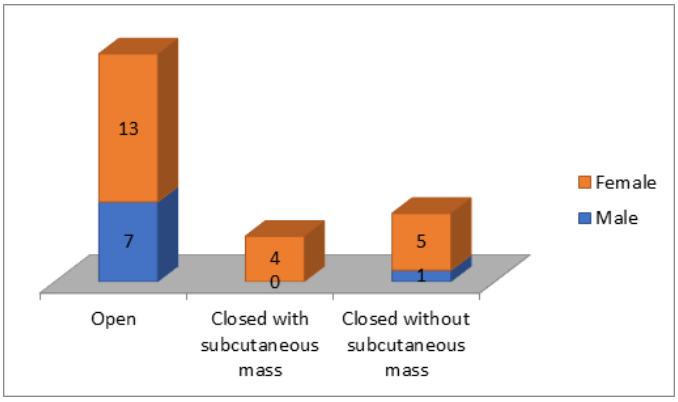
Chart 2: Age wise distribution of study subjects.

Distribution of different types of Spinal Dysraphism

Table 3: showing distribution of different types of spinal dysraphism.

Type of Spinal Dysraphism				
	Open	Closed with subcutaneous mass	Closed without subcutaneous mass	Total
Male	7	0	1	8
Female	13	4	5	22
	20	4	6	30

Chart 3: Column chart showing distribution of different types of spinal dysraphism



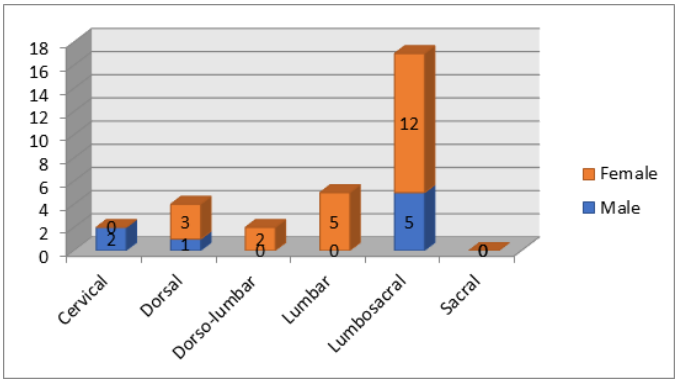
In our study open spinal dysraphism was more predominant than closed type.

Region wise distribution of spinal dysraphism

Table 4: showing region wise distribution of spinal dysraphism

Common region of spinal dysraphism							
	Cervical	Dorsal	Dorso-lumbar	Lumbar	Lumbo-sacral	Sacral	Total
Male	2	1	0	0	5	0	8
Female	0	3	2	5	12	0	22
	2	4	2	5	17	0	30

Chart 4; column chart showing region wise distribution of spinal dysraphism



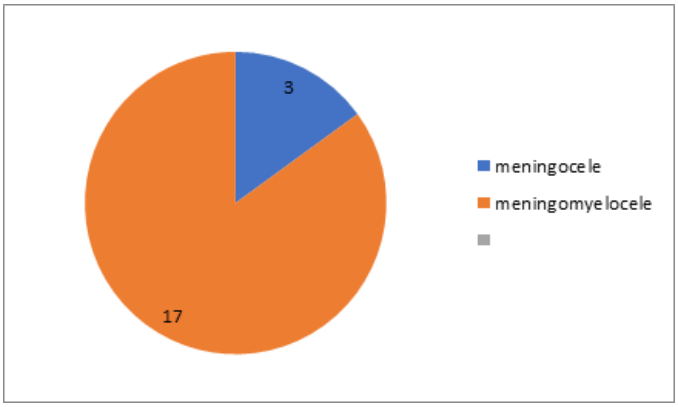
In our study, lumbo-sacral region was the most common location for spinal dysraphism , followed by lumbar and dorsal.

Spectrum of open spinal dysraphism

Table 5: showing spectrum of open spinal dysraphism in study subjects

Type of open spinal dysraphism		
Meningomyelocele	17	85%
Meningocele	3	15%
Hemi meningomyelocele	0	0
Hemi meningocele	0	0
Total	20	100%

Chart 5: Pie chart showing distribution of open spinal dysraphism

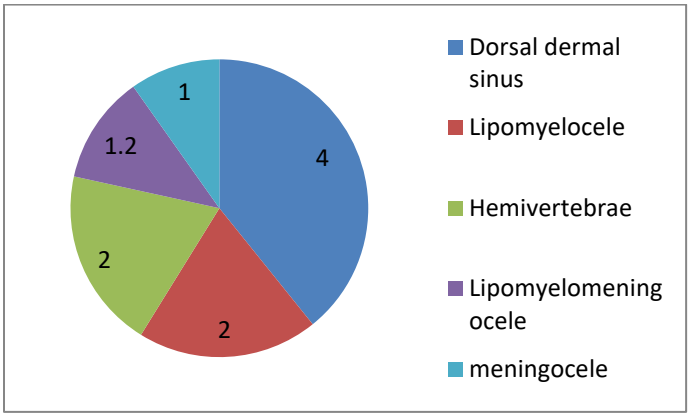


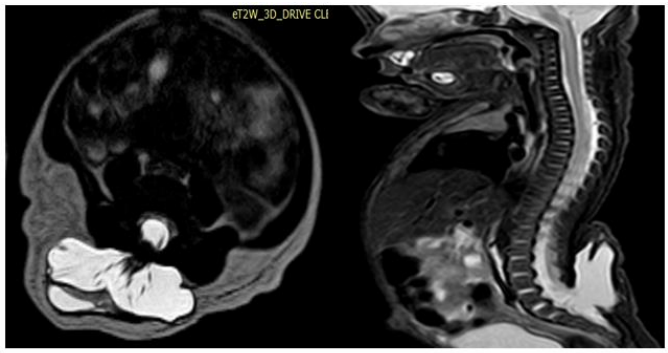
Spectrum of Closed Spinal Dysraphism

Table 6: showing spectrum of closed spinal dysraphism in study subjects

Type of closed spinal dysraphism		
Dorsal Dermal Sinus	4	40%
Lipomyelocele	2	20%
Hemivertebrae	2	20%
Lipomyelomeningocele	1	10%
Meningocele	1	10%
Total	10	100%

Chart 6: showing spectrum of closed spinal dysraphism





T2 Weighted axial section Mid sagittal STIR sequence.

Figure 1: 5 Days Old Female Baby With Lower Back Swelling

Lumbo-sacral meningomyelocele: Evidence of herniation of neural placode seen on axial T2 weighted images noted in lumbo-sacral region through splaying of posterior vertebral elements (spina bifida), forming a cystic swelling in lower back.

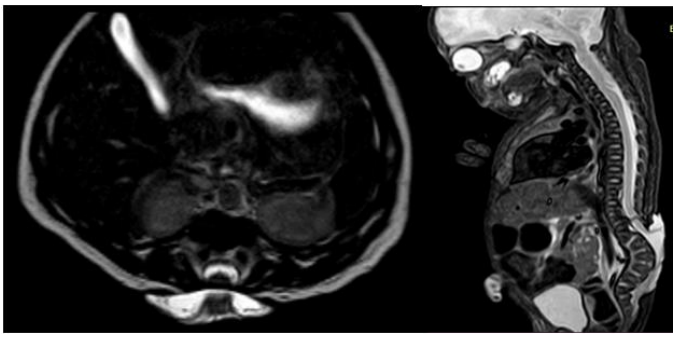
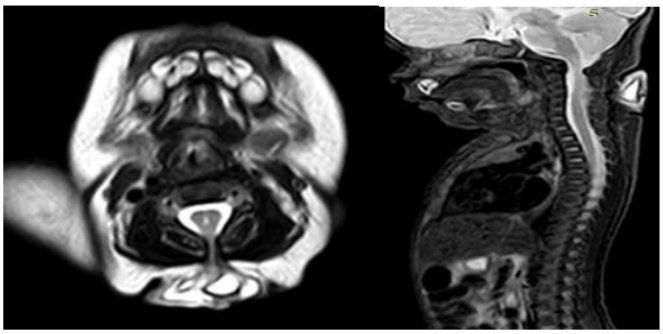


Figure 2: 1 Day old female baby with lower back swelling

Lumbosacral meningomyelocele with Arnold chiari malformation, kyphosis.



T2 Weighted axial section Mid sagittal STIR sequence.

Figure 3: 6 Day old male baby with posterior neck swelling

Cervical meningomyelocele with syrinx

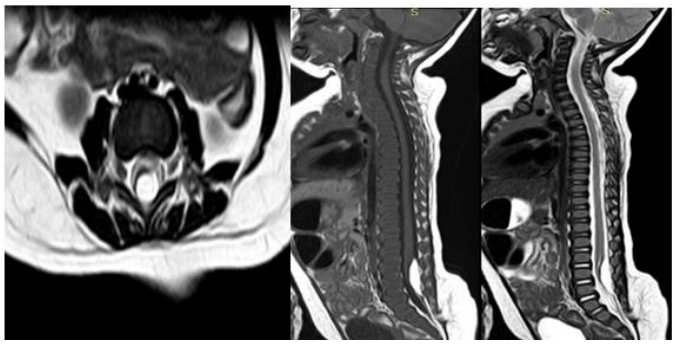


Figure 4: 8-month-old female baby with low back swelling.

Intradural lipoma with low lying tethered cord.

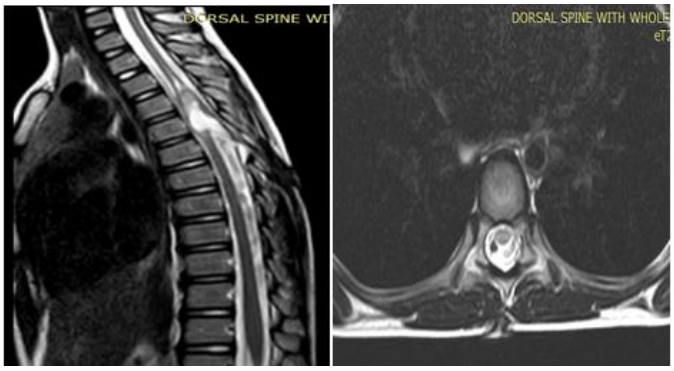


Figure 5: 6 year old male presenting with upper back dimple

Dorsal dermal sinus with long segment syrinx.

Discussion

Spinal dysraphisms are a spectrum of Congenital abnormalities of the spine and spinal cord. The purpose of MR imaging in spinal dysraphism is:

1. Detection of detailed anatomy
2. For soft tissue characterization of lesion.
3. For presurgical planning
4. For early detection and prompt neurosurgical correction of occult spinal dysraphism in order to prevent permanent neurological damage.

The age of the patients in our study ranged from 1 day to 25 years. Most of the children are below 1month of age.

In our study, of the 30 patients 22 (73.3%) were female patients and 8 (27%) were male patients similar to study by Mohamed Fathy Dawodh et al., in which 18 are female patients and 14 are male patients[5].

Location of spinal dysraphism in our study were noted in the cervical region, dorsal region, lumbar region, sacral region, lumbosacral region. Among these lumbosacral region is the commonest location, which constituted 17 (56.6%). In a study by Mohamed Fathy Dawodh et al., lumbosacral region is the commonest location which constituted 11 cases (73.3%). [6]

Open defects are associated with abnormalities such as Hydrocephalus, Arnold-Chiari II, syrinx, kyphosis, spina bifida, tethered cord. In our study hydrocephalus constituted 11 cases, Arnold-Chiari type 2 constituted 7 cases. Closed defects in our study were associated with dermal sinus, vertebral anomalies, synrix, scoliosis, spina bifida, tethered cord, intradural lipoma.

Comparing with the above mentioned studies, our study revealed that MRI is the imaging modality of choice to demonstrate the spectrum of findings in patients with suspected spinal dysraphism.

Conclusion

MRI with its multiplanar capabilities and superior soft tissue contrast, allows detection of detailed anatomy and characterization of congenital spinal disorders. Imaging of spinal dysraphism is convoluted as various conditions are involved in it which can have variable imaging appearance. An organized approach and MRI can help in making the correct diagnosis as it does not involve ionizing radiation, is advanced and safe modality for assessing the spinal cord at all ages and defining complex spinal dysraphism.

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