

ANALYSIS OF POSTOPERATIVE COMPLICATIONS IN SPINAL DYSRAPHISM OPERATED PATIENTS IN LESS THAN ONE YEAR VERSUS MORE THAN ONE YEAR CHILDREN IN TERTIARY CARE HOSPITAL-RURAL HEALTH SETUP

¹*Dr Vidhyaalakshmi, ²Dr Sathish Anand VS

¹Junior Resident, MBBS, GENERAL SURGERY, SAVEETHA MEDICAL COLLEGE, SIMATS, ORCID ID: 0009-0002-2372-5963

²Associate Professor and HOD of Neurosurgery, SAVEETHA MEDICAL COLLEGE, SIMATS, ORCID ID: 0000-0001-9078-2162

*Corresponding author: Dr Vidhyaalakshmi, ORCID ID: 0009-0002-2372-5963

ABSTRACT

INTRODUCTION: Spinal dysraphism is a broad category of primary spinal anomalies encompassing disorders related to spina bifida, which are mainly classified into spina bifida occulta and spina bifida aperta. These results from defective closure of the neural tube during early embryogenesis, leading to a spectrum of congenital spinal malformations. These conditions often present with cutaneous, neurological, and urological manifestations, significantly impacting the quality of life if not managed early. **MATERIALS AND METHODS:** A retrospective study was conducted in a rural population at the Department of Neurosurgery, Saveetha Medical College, Thandalam, Chennai, Tamil Nadu. The study period extended over two years, from October 2016 to December 2025. A total of 70 children diagnosed with spinal dysraphism were included in the study. **RESULTS:** Among the 70 children, 31.4% (n = 22) were aged <1 year and 68.6% (n = 48) were >1 year, with an overall female predominance. Children presenting before 1 year of age demonstrated favorable outcomes, with no bladder and bowel involvement, neurological deficits, or deformities. In contrast, delayed presentation (>1 year) was associated with higher morbidity, including bladder and bowel dysfunction (29.1%), neurological deficits (25%), and deformities (8.3%). Lumbosacral lesions were the most common presentation, and meningocele/lipomeningocele accounted for 66.6% of cases. Postoperative complications were minimal, with isolated cases (1.4% each) of surgical site infection, wound dehiscence, and cerebrospinal fluid leak. No significant recurrence was observed during the follow-up period. **CONCLUSION:** Early presentation and timely surgical intervention in spinal dysraphism are associated with improved neurological and functional outcomes, whereas delayed presentation is linked to a higher incidence of deficits and morbidity. These findings highlight the importance of early diagnosis and management, with better outcomes observed in children presenting before one year of age.

Keywords: Spinal Dysraphism, Postoperative Complications, Meningomyelocele, Neural Tube Defects, Treatment Outcome

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INTRODUCTION

The term "spina bifida" is derived from Latin, meaning "open spine." Spinal dysraphism falls under a broad category of primary spinal anomalies. Dysraphism is a Greek word derived from two words (dys and raphe, meaning "defective" and "seam," respectively). Dealing with disorders related to spina bifida. Spina bifida is defined as the congenital absence of the spinous process and variable amounts of the lamina with or without visible exposure of the meninges or neural tissue. These deformities are classified into aperta (visible lesion) and occulta (with no external lesion) and occur in the period of embryogenesis between the 2nd and 6th weeks of gestation.¹ The occulta type is always palpable, and overlying skin is seen.^{2,3} Spina bifida occulta is found to be associated with

diastematomyelia, tethered cord, lipoma or dermoid tumor. Spina bifida aperta or open spinal dysraphism, refers to a defect in which neural tissues communicate with the external environment, such as meningocele and myelomeningocele. The most common ones are meningocele, lipomyelomeningocele and myelomeningocele. Meningocele is referred to as a defect in the vertebral arches with cystic dilation by the spinal cord that does not have any structural or functional anomaly. Myelomeningocele, being the predominant form, is defined as the congenital defect present in the vertebral arches with cystic dilatation of the meninges.⁴ This condition involves the structural and functional abnormality of the spinal cord or cauda equina, with risk increasing in a single or two affected children, previously rating 1-2% and 6-8%, respectively. It is also associated with hydrocephalus, overt HCP, and Chiari type 2

malformations. Lipomyelomeningocele refers to the subcutaneous lipoma passing through the midline defect in the lumbodorsal fascia and vertebral neural arch and merging with the abnormally tethered cord.⁵ Asymptomatic lipomas of the filum terminale are present in almost 0.2-4% of children.^{6,7} Tethered cord syndrome is defined as an abnormally low conus medullaris, usually related to a short, thickened filum terminale or an intradural lipoma. This condition is also known as the lipoma of the cauda equina.⁸ The contents mainly involved in these defects are meninges, cerebrospinal fluid, and neural elements. The level of occurrence varies, especially in females. Diagnosing at a very early stage is utmostly essential to avoid irreversible neurological damage, especially when tethered cord syndrome is involved.⁹ The condition requires surgery and a multidisciplinary approach involving specialists.

The aim of the study is to compare the various outcomes of surgery local complications and focal neurological deficits in both the immediate postoperative period and after discharge of the patients. The outcomes are also compared with various other parameters (demographic factors, procedure, etc.).

MATERIALS AND METHODS

This retrospective study was conducted in rural area and in renowned institute - Department of Neurosurgery in Saveetha medical college, Thandalam, Chennai, Tamilnadu. Duration of study was from the past ten years from January 2016-December 2025. The study included 70 children who were diagnosed to have spinal dysraphism.

Inclusion criteria

Children belonging to age groups between 0-15 years of age, only spinal dysraphism involved, and operated patients included in this study.

Exclusion criteria

Population above 15 years of age groups were excluded from the study, spinal dysraphism associated with other illness and non operated patients were excluded from the study.

Background of the study

Computed tomography of the spine and magnetic resonance imaging play a very important role in confirming the diagnosis. These diseases also diagnosed in ultrasound fetal scans. All cases underwent surgical repairs with standard techniques. Post operative care was given to the patients in view of identifying any local complications and also assess neurological status of the children. Follow up of the children was done every six months to

our opd for assessing any complications and to assess neurological status. Data collection was done using retrospectively using the records available. Statistical analysis was done in IBM software SPSS.

The findings from the analysis indicated a correlation between the surgical techniques used and the outcomes observed in the children's neurological assessments. Additionally, the follow-up visits provided valuable insights into the long-term effects of the procedures, guiding future treatment protocols.

Statistical analysis

A total of 70 patients were included in the study. Statistical analysis was performed using IBM SPSS software. Categorical variables were analyzed using the Chi-square test or Fisher's Exact test, as appropriate, with a p-value < 0.05 considered statistically significant. There was no statistically significant association between age at presentation and sex distribution (p = 0.29) or type of dysraphism (p = 0.40). However, age at presentation showed a significant association with preoperative neurological status. Children presenting after 1 year of age had a significantly higher incidence of bladder and bowel involvement and neurological deficits compared to those presenting before 1 year (p = 0.003 and p = 0.013, respectively). Postoperative new deficits were infrequent and did not show a statistically significant association with age (p = 0.30). Wound-related complications were minimal in both groups and were also not significantly associated with age (p = 1.000). Follow-up outcomes demonstrated improvement in a proportion of patients, with early presenters showing relatively better recovery, reaching borderline statistical significance (p = 0.041). No cases required resurgery, and no recurrence was observed during the study period. Overall, early presentation and intervention were associated with better neurological and functional outcomes, whereas delayed presentation was linked to a higher burden of preoperative deficits.

RESULTS

Out of 70 children included in the study, 31.4% (n = 22) were aged less than 1 year and 68.6% (n = 48) were aged more than 1 year. Among children <1 year, 12 (54.5%) were males and 10 (45.5%) were females. In the >1 year group, 20 children (41.6%) were males and 28 (58.3%) were females, showing a female predominance in the overall study population, consistent with studies by Shahinoor AM et al. and Anderson et al.^{10,11} (**Table 1**)

TAB :1 AGE AND SEX DISTRIBUTION TAKEN FOR THE STUDY

VARIABLES		% WITH FREQUENCY
AGE	<1 YEAR	31.42%(n-22)
	> 1 YEAR	68.57%(n-48)
SEX		
	MALE	54.5.% (n-12)(<1YEAR) 41.6% (n-20)>1YEAR
	FEMALE	45.5.% (n-10)< 1YEAR 58.3%(n-28)>1YEAR

With respect to postoperative outcomes, children presenting before 1 year of age showed favorable results, with no cases of bladder or bowel involvement, neurological deficits, or deformities. In contrast, among children presenting after 1 year, 14 cases (29.1%) had bladder and bowel involvement, 12 cases (25%) had neurological deficits, and 4 cases (8.3%) developed

deformities, indicating a higher burden of morbidity with delayed presentation. (**Table 2**)

TAB :2 - ASSOCIATION OF AGE AT PRESENTATION WITH CLINICAL OUTCOMES AND COMPLICATIONS

VARIABLES	< ONE YEAR	> ONE YEAR
PRE OP NEUROLOGICAL DEFICITS	0	28
POST OP NEW DEFICITS	0	2
DELAYED WOUND HEALING	3	1
FOLLOW UP	7	21
RESURGERY	0	0

Most midline swellings were lumbosacral, similar to Hossain et al. and Agarwal et al.¹² Only one child (0.014%) under one year developed SSI; no other immediate complications were seen. Meningocele/lipomeningocele accounted for 66.66% in our study, comparable to 61.11% reported by Rao H. Prasad. Focal neurological deficits occurred in five children (0.07%), mainly

bladder and bowel incontinence, with two cases of limb deformity.

TABLE -3::SEX DISTRIBUTION ACCORDING TO AGE WITH STATISTICAL COMPARISON (N=70)

SEX	<1 year n (%)	> 1year n (%)	χ^2 value	df
MALE	12 (54.5%)	20(41.7%)	1.12	1
FEMALE	10(45.5%)	28(58.3%)		
TOTAL	22	48		

No postoperative new deficits were observed in children aged less than 1 year. In contrast, among children older than 1 year, one child (1.4%) developed bladder and bowel incontinence and one child (1.4%) developed limb deformity. Wound-related complications were minimal, with one case each of surgical site

infection (1.4%), wound dehiscence (1.4%), and CSF leak (1.4%) in the less than one-year age group population, while only one case of wound infection (1.4%) was noted in the more than one-year age group. Premlal et al , in his study showed that CSF leak is the most common complication (20.43%).^{2,13} (Table 3)

TABLE :4 - PVALUE AND CI INTERVAL FOR ALL PARAMETERS

PARAMETERS	P VALUE	95%CI
SEX DISTRIBUTION	0.29	0.67-2.98
PRE OP NEUROLOGICAL DEFICITS	0.003	18.2-43.2
POST OP NEW DEFICITS	0.30	0.8-16.8%
WOUND HEALING(LOCAL EFFECTS)	1.000	0.72-5.11
FOLLOW UP IMPROVEMENT	0.041	0.52-0.98
RESURGERY	1.000	-

Follow-up duration ranged from a minimum of 1 year up to 10 years. In children less than 1 year of age, bladder and bowel incontinence, neurological deficits, and limb deformities were observed in 5 (7.1%), 2 (2.8%), and 0 (0%) cases respectively. In children more than 1 year of age, 14 children (20%) had bladder and bowel involvement, and 10 (14.3%) showed improvement on follow-up. Similarly, 14 children (20%) had neurological deficits. Improvement was seen in 7 (10%) cases, and 4 children (5.7%) had persistent limb deformities. (Table 4)

No significant recurrence was observed during the follow-up period, and there was no requirement for re-surgery. Overall,

early surgical intervention before 1 year of age was associated with better neurological and functional outcomes, whereas delayed presentation was associated with a higher incidence of deficits and deformities.

These findings suggest the importance of timely diagnosis and treatment in optimizing patient recovery. Further research is warranted to explore the underlying mechanisms that contribute to these differences in outcomes.

Figure 1 shows the preoperative, interoperative and radiological images of spinal dysraphism patients. (Fig. 1)

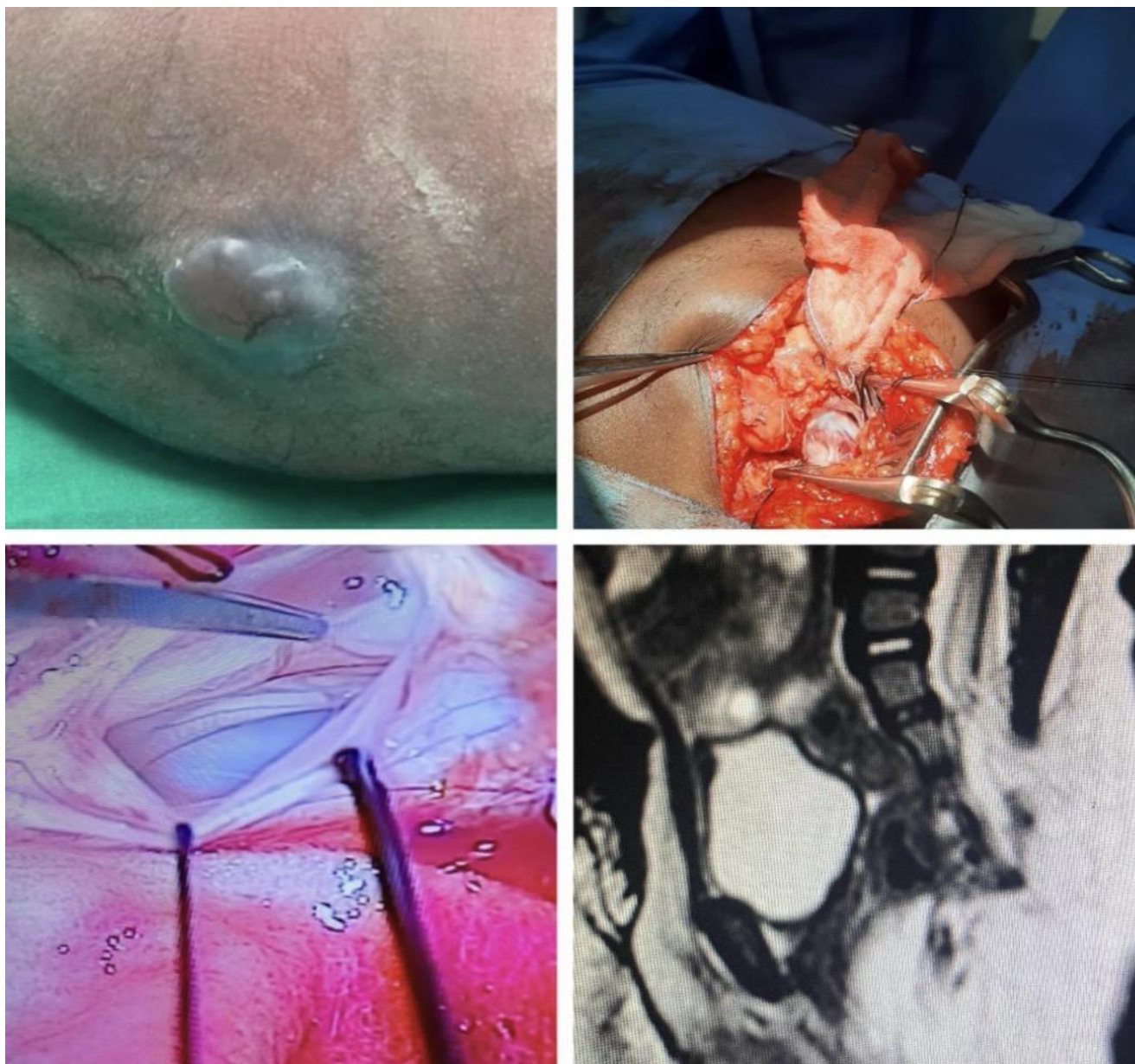


FIGURE :1 SHOWING PRE OP INTRAOP AND RADIOLOGICAL IMAGES OF SPINAL DYSRAPHISM PATIENTS.

DISCUSSION

Neural tube defects are congenital anomalies arising early in fetal development due to improper closure of the precursor of the brain and spinal cord. They include conditions such as spina bifida, anencephaly, and encephalocele. Spinal dysraphism forms a subset of these defects and can be largely prevented by periconceptional folic acid supplementation, healthy diet, avoidance of teratogens, and prenatal screening. An estimated 2–3 lakh children are affected by these disorders.

Spinal dysraphism refers to a spectrum of congenital abnormalities caused by defective closure of dorsal midline structures during embryogenesis. These defects can occur at any spinal level.

The underlying embryological processes include gastrulation, primary neurulation, and secondary neurulation.^{14,15} Errors during gastrulation result in complex dysraphism and split cord malformations, while defects in primary neurulation lead to open lesions such as myelomeningocele. Abnormal disjunction causes lipomatous malformations, and defects in secondary neurulation result in tethered cord, tight filum terminale, and related anomalies. Rare conditions such as neurenteric cysts and diastematomyelia arise from notochordal defects.^{16,17}

These anomalies are often associated with cutaneous markers. High-risk markers include dermal sinus, lipomas, hemangiomas, atypical dimples, and hypertrichosis, while low-risk markers

include simple dimples, pigmentation changes, and skin tags. The risk increases when multiple markers coexist.

Most cases in this study involved the lumbar and lumbosacral regions, which account for 80–90% of spinal dysraphism. MRI is the investigation of choice, with many cases detected prenatally. Common entities include lipomyelomeningocele and myelomeningocele, with higher lesions causing severe neurological deficits and lower lesions presenting with bladder and bowel dysfunction. Rare forms such as hemimyelomeningocele are also described.¹⁸ Patients typically present with neurological deficits, bladder and bowel dysfunction, orthopedic deformities, and cutaneous markers. MRI of the spine and brain is essential to assess associated anomalies such as Arnold Chiari malformation and hydrocephalus.¹⁹

Management is multidisciplinary, involving neurosurgery, urology, orthopedics, and pediatrics. The primary surgical goals are detethering the cord, preserving neurological function, preventing deterioration, eliminating infection, and reconstructing normal anatomy. Surgery involves midline exposure, careful dissection, dural opening, identification of neural structures, untethering, and watertight dural closure. Postoperative care includes monitoring neurological status, bladder and bowel function, and wound complications, with long-term follow-up to detect retethering.

CONCLUSION

Most of the patients had a better overall outcome rate (92.85%) compared to the study by Borcek et al. (2012), which reported 82.2% of patients with a good postoperative outcome. However, no mortality rates were reported in both of the age groups. Early presentation and timely surgical intervention in spinal dysraphism are associated with improved neurological and functional outcomes, whereas delayed presentation is linked to a higher incidence of deficits and morbidity. These findings are supported by previous studies emphasizing the importance of early diagnosis and management in reducing long-term complications.^{20,21} Hence, better outcomes are seen in children in less than one year. Thus, spinal dysraphism is a complex disorder involving multiple organs, systems, requiring a multidisciplinary approach for management and better outcomes. However, surgery remains the treatment of choice, along with optimal postoperative care.

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