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Original Research Article

Study of Presentation, Management and Outcome of Patients undergoing Surgery of Spinal Dysraphism

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Abstract

Background: Three developmental stages gastrulation (two to three weeks), primary neurulation (four to six weeks), and secondary neurulation—can be used to summarise the development of the spinal cord (5–6 weeks). Spinal dysraphism is the term used to describe any deviation in any of these stages that results in abnormalities in the spine and spinal cord. Spinal dysraphism is estimated to affect 1 in 1000 live births. The current study focuses on the surgical outcomes, treatment, and various manifestations of spinal dysraphism.

Methods: A 12-month study on the surgical management of spinal dysraphism was conducted at the Department of Neurosurgery, Bangur Institute of Neurosciences, IPGMER, Kolkata, West Bengal. The clinical features, treatment, and surgical results in cases with spinal dysraphism were described in the current study.

Results: 54 patients in total were involved in the trial. Ages ranged from one day to seventeen. Incidence is higher in females (n=31; 57.40%) than in men (n=23; 42.60%). Out of a total of 54 instances, the most prevalent manifestation was a swelling across the middle of the back in 32 cases (59.2%). A ruptured myelomenigocele or myelocele sac affected 8 patients (14.81%). Dermal sinus, Hypertrichosis, and skin dimples—markers of spina bifida of the occult type—are found in 3 (5.55%), 2 (3.70%), and 1 (1.85%) of patients, respectively. All patients underwent a cranial-spinal MRI to assess any congenital defects connected to spinal dysraphism. All of them had one or more abnormalities. More individuals had spina bifida aperta (37), compared to 17 who had bifida occulta. 33 (61.11%) of the cases had myelomeningocele, while 4 (7.47%) had myelocele. Lipomyelomeningocele 7 (12.96%), meningocele 3 (5.55%), lipomyelocele 2 (3.70%), diastematomyelia in 2 ((3.70%), dermal sinus in 2 ((3.70%), and spinal lipoma in 1 (1.85%) instance were the most frequent findings in closed type. Prior to the ultimate operation, the majority of individuals with hydrocephalus need shunt surgery. The post-operative care is equally crucial for a successful recovery and to prevent problems. The sphincteric result of surgery must be evaluated using electro myographic and urodynamic investigations. The most common symptom to reduce is pain. Following surgery, motor deficits recover more quickly than sensory deficits and bladder dysfunctions. These patients' outcomes are constantly susceptible to retething and delayed neurological decline.

Conclusion: Spinal dysraphism is a complex illness that must be managed using a multidisciplinary strategy. According to the current study, surgery is the main treatment together with adequate post-operative care for the patient's higher quality of life.

Keywords: Spinal Dysraphism, Myelomeningocele, Surgery.

Introduction

The term "spinal dysraphism" or "neural tube defect" (NTD) covers a diverse range of congenital spinal malformations brought on by early defects in the closure of the neural tube and abnormal caudal cell mass development [1].

Progressive neurologic decline can result from several types of spinal dysraphism. Anatomical abnormalities in the midline structures of the back, particularly the absence of some neural arches, as well as flaws in the skin, filum terminale, nerves, and spinal cord are characteristics shared by the entire group [2].

There are two types of spinal dysraphism: closed forms and open forms. Having a neural tube defect in the open form is a significant congenital condition. Anencephaly or encephalocele may develop from the neural tube failing to fuse at the skull. The defect that results if the tube does not fuse along the spine is an open type of dysraphism, such as meningomyelocele, myelocele, or meningocele. Additional severe neurological, musculoskeletal, genitourinary, and intestinal defects are typically seen in infants with NTDs. The open variants, which could be categorised as spina bifida aperta, are frequently linked to hydrocephalus and Arnold Chiari malformation type II [3,4].

Spina bifida occulta refers to spina bifida's closed form. Bony spina bifida occulta with undamaged overlaying skin may occur in 5–10% of the general population. Most of these cases are stumbled upon. Variable lack of numerous neural arches and various cutaneous abnormalities, such as hemangiomas, cutis aplasia, hairy patches, diastematomyelia, or lipomas, are the hallmarks of spina bifida occulta (lipomyelomeningocele).

Later in life, patients with spina bifida occulta may have scoliosis. This is frequently connected to low-lying conus and other abnormalities of the spinal cord. When an infant's conus is below the L2-L3 interspace, cord tethering should be taken into account. According to the definition of a "tethered cord," it may be fastened to the vertebral column or subcutaneous tissues with a thicker fibrous band or filum terminale [5].

A negative family history is present in 95% of couples having a foetus affected by ONTD. The majority of ONTDs are brought on by multiple inherited factors, including genetic and environmental factors [6].

Spinal dysraphism is thought to affect 1 in every 1,000 live births. Due to increased prenatal care, folic acid supplements, high-resolution ultrasonography for prenatal screening, and biochemical indicators, the prevalence of spinal dysraphism has decreased globally over the past few decades.

Materials & Methods

The Department of Neurosurgery at the Bangur Institute of Neurosciences, IPGMER, Kolkata, West Bengal, conducted this prospective investigation on 54 spinal dysraphism cases. The research was conducted from January to December of 2014. Most of the cases came from the paediatric and gynaecology departments. Patients ranged in age from one day to

seventeen years old. Our goal is to research the prevalence, clinical manifestations, and surgical results in patients with spinal dysraphism. Patients are evaluated clinically based on their medical history, their current symptoms, and a neurological examination.

All patients underwent a craniospinal MRI, and radiological findings and related anomalies were noted for planning patient care. These patients received the necessary surgical treatments, such as ventriculoperitoneal shunts, cord detethering, and sac excision and repair. Following their surgeries, all of these patients had their results reported and evaluated. In this analysis, patients who have had a minimum three-month follow-up are included.

Results

54 patients in total were involved in the trial. Ages ranged from one day to seventeen. Incidence is higher in females (n=31; 57.40%) than in men (n=23; 42.60%).

Table 1: Sex Distribution

Sex	No. of Cases	Percentage
Male	23	42.60%
Female	31	57.40%

In 54 cases, 39 (72.22%) had Spina bifida aperta (open form), which was more prevalent than Spina bifida occulta (15 patients, 27.77%).

Table 2: Type of Dysraphism

Type	No. of Cases	Percentage
Open	39	72.22%
Closed	15	27.77%

The youngest patient in our study was one day old, and the oldest was 17 years old. Thirteen patients were in the age range of one month to one year, and 29 patients, or 53.70%, were under one month old. The study group's age was 2.8 years on average.

In this investigation, spinal dysraphism was observed across the spine. The lumbo-sacral area was the most frequent place, occurring in 28 cases (51.8%). The dorso lumbar area was located next in 14 (25.92%) individuals. Spina bifida is seen in six children (11.11%) in the upper dorsal region and two (3.70%) in the sacral region. This abnormality affected four patients (7.40%) in the cervical area.

Table 3: Site of the Lesion

Site	No. of cases	Percentage
Cervical	4	7.40%
Dorsal	6	11.11%
Dorso lumbar	14	25.92%
Lumbo sacral	28	51.85%
Sacral	2	3.70%

Out of a total of 54 instances, the most prevalent manifestation was a swelling across the middle of the back in 32 cases (59.2%). In 8 individuals (14.81%), the myelomenigocele or myelocele sac had ruptured. Dermal sinus, Hypertrichosis, and skin dimples—markers of spina bifida of the occult type—are found in 3 (5.55%), 2 (3.70%), and 1 (1.85%) of patients, respectively.

5 (9.25%) individuals had previous surgical scars. There are 11 (20.37%) patients with neuro orthopaedic foot abnormalities like talipes equinovarus, high-arched foot, leg length discrepancy, and flat foot. 3.5% of the patients had a substantial scoliosis. Nine patients (16.66%) had severe back discomfort when they arrived. Lower limb weakness, which was evident in 28 (53.7%) of the patients, was the most prevalent neurological abnormality. Twenty one (388.88%) individuals had sensory loss. Sphincter dysfunctions like faecal or urine incontinence affected 17 people (31.48%). Muscular atrophy (9, 16.66%), gait issues (7, 12.96%), and trophic ulcers in 4 (7.40%) individuals were the other neurological dysfunctions identified.

Table 4: Clinical Presentations

Clinical presentations	No. Of cases	Percentage
Cutaneous:		
Massskin covered	24	44.45%
Ruptured	8	14.81%
Tuft of hair(hypertrichisis)	2	3.70%
Dermal Sinus	3	5.55%
Dimple over skin	1	1.85%
Sub cutaneous Lipoma	4	7.40%
Scar of previous surgery	5	9.25%
Orthopedic:		
Backache	9	16.66%
Foot deformities	11	20.37%
Scoliosis	3	5.55%
Neurologic:		
Motor weakness	29	53.70%
Sensory deficits	21	38.88%
Sphincter dysfunction	17	31.48%
Muscular atrophy	9	16.66%
Gait disturbances	7	12.96%
Trophic Ulcerations	3	5.55%

All patients underwent a cranial-spinal MRI to assess any congenital defects connected to spinal dysraphism. All of them had one or more abnormalities. More individuals had spina bifida aperta (37), compared to 17 who had bifida occulta. 33 (61.11%) of the cases had myelomeningocele, while 4 (7.47%) had myelocele. Lipomyelomeningocele 7 (12.96%), meningocele 3 (5.55%), lipomyelocele 2 (3.70%), diastematomyelia in 2 ((3.70%), dermal sinus in 2 ((3.70%), and spinal lipoma in 1 (1.85%) cases were the most frequent findings in closed type. Hydrocephalus was the most frequent related abnormalities, occurring in 23 patients (42.59%), followed by Arnold chairi malformation type 11 in 21 patients (38.88%). In this investigation, there were cases of syringomyelia (11, 20.37%) and low-lying tethered chord (18, 33.33%). Less often observed conditions were thickened filumterminale 4(7.4%), syringo hydromyelia 3(5.55%), sacral agenesis in 2(3.70%), corpus callosal agenesis 2(3.70%), arachnoid cyst 1(1.85%), and corpus callosal thinning 1(1.85%).

Table 5: MRI Findings

Congenital Anomaly:	No. of Cases	Percentage
Myelomeningocele	33	61.11%
Myelocele	4	7.47%
Lipomyelomeningocele	7	12.96%
Meningocele	3	5.55%
Lipomyelocele	2	3.70%
Diastematomyelia	2	3.70%
Dermal sinus	2	3.70%
Spinal lipoma	1	1.85%
Associated Anomalies:		
Hydrocephalus	23	42.59%
Arnold chairi malformation type11	21	38.88%
Low tethered cord	18	33.33%
Syringomyelia	11	20.37%
Thickend filumterminale	4	7.40%
Syringo hydromyelia	3	5.55%
Corpus callosal agenesis	2	3.70%
Sacral agenesis	2	3.70%
Arachnoid cyst	1	1.85%
Corpus callosal thinning	1	1.85%

In 24 cases, the myelomeningocele sac was removed, repaired, and the neural components were repositioned with primary closure. The remaining 9 instances required synthetic Goretex grafts, fascia lata, or paraspinous fascia to correct the dural deficit and stop the CSF leak. In two cases of CSF leaks, lumbar CSF drains were employed. In 27 (50%) instances, a ventriculoperitoneal shunt was performed for hydrocephalus. Of these 27 patients, 23 instances had hydrocephalus as a co-morbidity, while 4 cases developed hydrocephalus after surgery.

In 19 patients, the cord was untethered. Three of the cases involved post-operative meningomyelocele repair performed abroad that resulted in cord tethering from fibrosis. One patient had the fibrous septum completely removed, as well as the bony spur. In 10 patients (18.5%), lipoma subtotal or near total excision was performed due to involvement of neural tissues. These patients had lipomyelomeningocele, lipomyelocele, and filum terminale lipoma. One patient had a dermoid cyst, and the other two had dermal sinus.

Table 6: Surgical Procedures

Procedures	No. of cases	Percentage
Excision of sac & repair	33	61.11%
Ventriculo Peritoneal Shunt	27	50.00%
Detethering of cord	19	35.18%
Spinal lipoma excision	10	18.51%
Re-exploration	4	7.40%
Excision of the bony spur/fibrous septum	2	3.70%
Exploration and excision of Dermal sinus	2	3.70%
Excision of Dermoid Cyst	1	1.85%

CSF leak was the most prevalent surgical complication, occurring in 11 (20.37%) patients. With acetazolamide medication and the prone position, eight of these patients improved under conservative supervision. Three patients were unable to receive conservative care. These patients were treated with duraplasty, re-exploration, and lumbar drain. There was pyrogenic meningitis in 4 (7.40%) of the cases.

Three patients had positive results from antibiotic treatment. One patient with severe meningitis died after failing to recover after receiving antibiotic treatment. In 4 (7.40%) instances following surgery, hydrocephalus occurred, necessitating a ventriculoperitoneal shunt. Pseudomeningocele occurred in 5 patients (9.25%), wound infections in 7 patients (12.96%), shunt infections in 3 patients (5.55%), and ventriculitis in 1 patient (1.85%), among other problems. In the weeks following surgery, two patients passed away.

Table 7: Post Operative Complications

Complications	No. of cases	Percentage
CSF leak	11	20.37%
Surgical site infection	7	12.96%
Pseudomeningocele	5	9.25%
Meningitis	4	7.40%
Hydrocephalus	4	7.40%
Shunt infection	3	5.55%
Ventriculitis	1	1.85%
Death	2	3.70%

In 29 cases where paraparesis or paraplegia was evident prior to surgery, 12 (22.22%) patients experienced improvement. In the postoperative period, three children (5.55%) deteriorated whereas 14 patients exhibited no change. Twelve out of twenty-one cases of severe sensory impairments have not changed and remain unchanged.

Most of the time (11, 20.37%), sphincter function was unchanged from the preoperative period. Tropic ulcers were found in three cases. In these, two patients had fully recovered, while one patient had only partially responded to treatment. In 14 cases, the neuro-orthopaedic abnormalities were present and did not get better. The nine back pain patients all experienced improvement following treatment.

Table 8: Surgical Outcome

Preoprative deficits	No. of cases	Improved	Status quo	Deterioration
Pain	9	9	-	
Motor weakness	29	12	14	3
Sensory loss	21	9	12	-
Sphincteric dysfunction	17	6	11	-
Trophic ulcer	3	2	1	-
Orthopaedic deformities	14	-	14	-

Discussion

Results from the current series are contrasted with those from other series. Some of these support our observations, while others go against them. 54 patients in total were involved in the trial.

There are two types of spinal dysraphism: open (spina bifida aperta) and closed (spina bifida occulta).

During development, neural tube abnormalities form along the neuroaxis that runs from the brain to the sacrum. These anomalies are caused by a deficiency in the three stages of spinal cord development—gastrulation (which lasts for two to three weeks), primary neurulation (which lasts for four to six weeks), and secondary neurulation that occur (5-6 weeks). 1 Spinal dysraphism is a result of early embryologic defects. [2]

The incidence is roughly 1 per 1000 live births in North America. The incidence in the United States is 0.6 instances per 1000 live births, however between 1983 and 1990, the rate gradually decreased from 5.9 to 3.2 cases per 10,000 births.[3] Incidence is declining in both the UK and continental Europe. According to statistics from the 1970s and 1980s, white people get the condition 2.5 times more often than black people do; it is notably prevalent in Belfast, Liverpool, and Dublin and rare in Japan. Great Britain continues to have a greater incidence than Japan.

We don't know the tendencies in India. Recent surveys reveal a considerable homogeneity of incidence across all categories and a lack of spatial variance.[4] Low socioeconomic areas have rates that are significantly higher. The introduction of new diagnostic techniques increased the prevalence of spina bifida occulta.[3] Spina bifida occulta in adults is seen in 5% of the 1172 consecutive corpses that James and Lassman routinely radiographed in 1972.

Myelomeningocele is more common in newborn girls than in newborn boys (1.2:1). In all of the literature's series, female patients somewhat outnumber male ones. The male to female ratio in the Klenderman (1973) *et al* series is 1:1.94. In contrast, the ratio in Berman's J. Islander (2001) series is 1:1.85. The ratio is 1:1.28 in Mohamed Fathy Dawoud's study from 2007. In the current series, the incidence is higher in females (n=31) than in males (n=23), with a sex ratio of 1:1.34.

The youngest patient in our study was one day old, and the oldest was 17 years old. The age range in Mohamed Fathy Dawoud's study from 2007[3] was one day to 34 years. Thirteen patients were in the age range of one month to one year, and 29 patients, or 53.70%, were under one month old. 38% of the participants in a research by Choux (1993) are infants. In the study by Besnik Elshani and Basri Lenjani (2014), the incidence is 90.9% for children under one year and 9.1% for children over one year. The study group's average age was 2.8 years, which is nearly comparable to previous series. 76.77% of the current series' participants are infants. The rarest incidence occurs in more than 10 instances.

In literary works, the lumbosacral area was the most frequent location. In the current series, the lumbo-sacral region was the most frequent site in 28 patients (51.85%), compared to 72.2% of cases in the study by Besnik Elshani & Basri Lenjani (2014).

In the current series, low case percentages are found in the cervical and sacral regions. Cervical instances were observed in 5.5% of Besnik Elshani & Basri Lenjani's (2014) study cases, and none at the sacral region. In a research by Mohamed Fathy Dawoud (2007), the lumbosacral region is the prevalent site in 62.5% of cases, whereas

cervical (9.3%) and sacral (6.3%) occurrences are rare.

In the current dataset, Spina bifida aperta (open type) was detected in 72.22% of cases, making it more prevalent than Spina bifida occulta. Birth symptoms of spina bifida aperta (open variety) include a back swelling. The open variety of MMC has a 0.2 to 0.4 per 1000 live births incidence rate. [4] At birth, the meninges and cord elements protrude through an external dural sac, causing a midline defect in the posterior parts of the vertebrae.

In myelomeningocele, the subarachnoid space has expanded, elevating the neural placode, whereas in myelocele, the placode is flush with the back surface. Poorly formed skin over swelling could indicate a CSF leak or exposed spinal cord. Meningitis may develop if CSF leaking is not promptly treated, greatly increasing the risk of morbidity. The degree of the meningocoele would determine how severe the sensory impairments were. The outlook gets worse as the level rises. In 68.6% of instances, there are various degrees of motor weakness. [5]

A typical symptom of a myelomeningocele is paraplegia caused by spinal cord abnormalities. To determine whether there is a neurologic deficit, the segmental anatomic level of the lesion is examined. 3.9% of cases of spinal dysraphism may have a high degree at the cervical level. 10% have thoracic myelomeningocele. There are three groups of lumbar myelomeningoceles (80%): high, low, and sacral. Myelomeningocele-related scoliosis can be acquired or congenital.[6]

Patients with higher spinal myelomeningoceles tend to experience more spinal abnormalities. Chiari malformation is present in nearly all MMC patients.[11] Medullary kinking, tectal beaking, and aberrant intrinsic nuclei are a few of the associated brainstem problems. Rectal prolapse may be a sign of sphincter dysfunction in extreme circumstances. In between 80 and 90 percent of MMC patients, hydrocephalus exists. Both communicative and obstructive elements could cause hydrocephalus. In 40 to 80% of patients, syringomyelia, a nonprogressive condition, occurs.[7] 30% of neonates with lower motor neuron lesions and more than 90% of myelomeningocele patients have neurogenic bladders.[8]

A localised cystic dilatation of the spinal cord's central canal is known as a myelocystocele. It manifests as skin-covered midline masses that are 5% of the time seen in the lumbosacral region.

Cloacal exstrophy is linked to myelocystoceles, and 62% of patients with this condition also have some degree of myelodysplasia. Rarely are myelocystoceles linked to hydrocephalus or a Chiari II malformation.

Spina bifida occulta is frequently discovered incidentally in both adults and children. With the exception of lipomyelomeningocele, it often has no symptoms or signs at birth.

The only indicator of the presence of a closed type may be the presence of cutaneous markers covering or nearby the spine.[9] They can happen anywhere along the spine, but the lumbosacral region is where they tend to happen most often.[10] The typical are cutaneous dimple, Smaller patch of silky hair if the dysraphism is in the cervical or upper thoracic region, Hairy patch of skin (hypertrichosis, faun's tail), Overlying the spine is a midline visible or felt mass (lipoma), skin sinus, Hemangioma capillaris.

Rudimentary tail (caudal appendage), atretic meningocele, which has a halo of red, pink, or brown skin surrounding a central area of thin, white skin (This has been likened to cigarette-burn type of skin stain).[11]

LMMs often result in a fibrous subcutaneous lipoma that tethers the spinal cord. Yamada

et al. showed that spinal cord tethering disrupts the spinal cord's typical energy metabolism, which can result in ischemia and gradual neuronal injury.

The most typical type of closed spinal dysraphism is called lipoma, which is a benign, squishy, rubbery tumour made up of mature fat cells. Lipoma can cause cord compression and a tethered chord if it is located in the dermis or the spinal canal. A myelomeningocele may be covered by a lipoma. Lipomyeloceles and lipo myelomeningocele's are both types of lipomas that have a dural defect.

Dermal sinus typically appears as a midline indentation that may or may not contain a tuft of hair and may have pigmentation of the skin in the vicinity. The lumbar or lumbarsacral region is where the common sites are.[12] Skin signs, CSF leakage, and neurological deficits or infections are among the findings. The infant is at risk for meningitis because more than 50% of them expand into the spinal canal.

Rare lesions with an endodermal epithelial lining are known as neuroenteric cysts. They are frequently found in the ventral position and in the thoracic or cervical areas. The cysts are a result of ongoing contact between endodermal and neuroectodermal tissues and are derived from endodermal inclusions found inside the spinal column.

Prenatal sonography can be used to predict spina bifida-affected foetuses with karyotypical abnormalities. However, if sonography is employed exclusively in the case of a prenatally identified spina bifida, 20% of cases are overlooked. According to some writers, cytogenetic analysis is appropriate in these circumstances. Simple spinal x-ray pictures can be used to detect occult abnormalities. For scoliosis observation, this is helpful. All cases in this study had a craniospinal MRI to check for any related abnormalities.

Myelomeningocele was the most frequent finding (61.11%) in the current study, and it was also seen in 46.85% of patients in the study of Mohamed Fathy Dawoud. In both the current and Mohamed Fathy Dawoud series, meningocele (3,4 cases), lipomyelocele (2,1), diastematomyelia in (2,1), dermal sinus (2,1), and spinal lipoma in (one case in both series) are less common. [3]

The most frequent concomitant cranial anomaly in the current sample was hydrocephalus, which was present in 23/54 (42.59%) patients. Comparing this incidence to western literature, it is lower. Additionally, hydrocephalus was the most frequent concomitant cranial anomaly found in 60/102 (58.8%) instances in Raj Kumar *et al*.[13] study. In the current study and Raj Kumar *et al* study, Arnold chairi malformation type 11 was found in 38.88% and 50.9% of cases, respectively, and was the second most prevalent related abnormalities.

Corpus callosal agenesis or thinning is a feature that is present in 5.55% of individuals, however Raj Kumar *et al* study shows that the prevalence is considerable (12.22%). The prevalence of syringo hydromyelia and tethered cord syndrome were other frequent related abnormalities.

The soft tissue beneath the dura is separated from it. Dural closure can be carried out either with or without grafting. The underlying fascia and musculature are separated from the skin's surface before being mobilised and approximated. Greater flaws or incisions may be used to cover larger problems if necessary. In the current study, sac excision and repair were performed in 33 patients (61.11%). In a research conducted in 2014 by Besnik Elshani and Basri Lenjani, 76.6% of patients underwent sac excision and repair. 25 instances (50%) in the current study required a ventriculoperitoneal shunt (VPS). After the myelomeningocele sac was repaired, 24% of them developed

hydrocephalus; nevertheless, in the current study, 7.4% of patients required a ventriculoperitoneal shunt due to hydrocephalus. According to a study by Banskota N. *et al*., primary closure was successful in 80% of patients, while the remaining 20% required paraspinal fascia reinforcement. Primary closure is possible in 24 cases (72.3%) of the current investigation. The remaining 9 instances required synthetic Goretex grafts, fascia lata, or paraspinous fascia to correct the dural deficit and stop the CSF leak.

The related hydrocephalus is a crucial prognostic factor. Before the lesion is repaired, a ventriculoperitoneal shunt can be placed to prevent CSF leak and the development of a pseudomeningocele. In the current investigation, there were 21 cases of Arnold Chairi Malformation type 2 but none of them received treatment with hind brain decompression, which is consistent with other studies.

Causative variables for cord tethering include physiological (tight or thick filum), anatomical (conus is situated at a lower level), and developmental factors (secondary to congenital anomalies, terminal lipoma, intraspinal lipoma, lipomyelomeningocele, split cord malformations, sacral agenesis and other occult dysraphic states) Retethering is the word used for postoperative tethering, which occurs following surgery to treat myelomeningocele or recurring adhesions after prior surgery.

These cord tethering causes, including lipoma, epidermoid, bony spur, and fibrous septum, were addressed all at once in a single treatment. Surgery for tethered cord syndrome is based on the principles of full cord detethering, appropriate dural reconstruction, and sufficient CSF space surrounding the spinal cord to prevent retethering. During surgery, the radiological results were verified. The other discoveries, including arachnoid bands, an atrophic conus, and an associated dermoid, which are to blame for the cord's tethering and neurological deficiencies, are addressed concurrently with the cord's untethering in a study by Raj Kumar, S.N. *et al*. (2003)[13]. Dermal sinuses were not identifiable in this investigation. One case of cutaneous sinus was successfully treated in the current investigation. In the current study, 35.18% of the time the cord was dethered. According to a Pang study, dethering is used to treat 81% of patients (1982).

Treatment for lipomyelomeningocele is difficult and carries a significant risk of neurological decline. The result is influenced by numerous factors. These include anatomical factors (such as the size of the lipoma, its location (midline or paramedian), a wide bony defect, damaged muscles and fascia, and poor cleavage at the neurolipomatus junction), physiological ones (such as the amount of traction and the cord's capacity to withstand the effects of traction), and pathological ones (vascularity of fibrolipomatous structures and associated anomalies). Vertical skin incision, dissection of subcutaneous lipoma, identification of upper and lower laminae and performing laminectomy, identification of normal dura above and below, and separation of dural tube from the thoracolumbar fascia all around are among the management principles. Free fat replacement over the dura fills empty spaces, shields soft tissue, stops CSF leaks, and stops skin edge necrosis.

Although surgical treatment of these lesions is more difficult and entails a higher risk for the patient, preventative surgery should be used to treat asymptomatic people with spinal lipomas and surgical treatment should be used to treat symptomatic patients.[14,15] Conus lipoma treatment for asymptomatic patients is still up for dispute. Finally, in recent series including more advanced operative tools and the redefining of surgical

goals, the hazards of surgical intervention appear to be decreasing. The reported series also show that intraoperative monitoring is very variable and lowers complication rates.[15] Rectal EMG, urethral EMG, rectal and bladder pressure, continuous EMGs, evoked EMGs, and SSEPs are among the monitoring methods that are available. Lipoma instances are treated in Choux's study (59%) and Anderson's study (49%) In the Choux research from 1993, 59% of instances are reported. Compared to other series, the current study treats 18.51% fewer spinal lipoma patients. Complete removal of the bony spur is required for split cord malformation type 1 and removal of the fibrous septum is required for split cord malformation type II.[16]

After surgical repair, CSF leak from the incision site occurred in 20.37% of patients in the current study, while 32.9% of cases were identified in a study by Raj Kumar (2003). Banskota study only found 4.87% of cases. Acetazolamide, prone positioning, or re-exploration and duraplasty employing fascia lata graft are used to treat these instances medically. In the current study, lumbar puncture was performed in 5.55% (3 instances), whereas Raj Kumar *et al*. treated 9.67% of cases with lumbar puncture. In the current study, pseudomeningocele developed in 9.25% of cases.

14.1% of the instances of pseudomeningocele in the Rajkumar *et al* research developed. There were no cases of pseudomeningocele in the study by Bansokota *et al*. 7.4% of the cases in the current study experienced post-operative hydrocephalus, which was treated with a ventriculoperitoneal shunt.[17] In contrast, a research by Bansokota *et al*. found that after meningomyelocele sac ectomy and repair, there were 24.3% of cases of hydrocephalus. Before the lesion is repaired, a ventriculoperitoneal shunt can be inserted to prevent CSF leak and the development of pseudo-meningocele. According to prior investigations, the present study found a low percentage of cases of ventriculitis (1 case) and meningitis (4 cases).

The most frequent symptom to get better is pain, followed by motor impairments. Post-operative bladder dysfunction and sensory impairments are unaffected. In the current study, pain decreased in every single case (9 out of 9; 100%), which is consistent with Raj Kumar *et al* study. [17]

Twelve (41.37%) of the patients who had upper or lower motor symptoms significantly improved after surgery, although three individuals actually got worse. Compared to 48.2% in the current study, 51.4% of patients in Raj Kumar *et al* study demonstrated neither improvement nor worsening. [17] As observed in Raj Kumar *et al* study, sensory loss and sphincter dysfunction did not significantly improve in the current investigation.

There are a variety of risk factors for neural tube abnormalities, including as folic acid deficiency, an older mother, a lower socioeconomic position, antiepileptic medications, and more. The prevalence of spinal dysraphism is declining globally, primarily in developed nations. This drop may be influenced by prenatal diagnosis and folic acid fortification. In undeveloped nations, low socioeconomic status and uneducated moms are not regularly screened and checked throughout pregnancy. There are sizable percentages of pregnant women who do not take folic acid supplements.[18,19]

Folic acid supplementation is effective in lowering the prevalence of NTDs, including spinal dysraphism. [19]

Conclusion

The elusive start of neurological and physical symptoms and the mild emergence of some cutaneous signs make the diagnosis of closed

spinal dysraphism challenging. Delays in treatment and diagnosis of these patients increase their chance of developing infections and neurologic impairments, among other dangers. Although MRI is the preferred inquiry, high-resolution CT can be helpful, particularly in split cord malformation type 1 for showing a bony spur.

Delineating the spinal cord and paraspinal soft tissue is quite effective with MRI. Even in children without neurological deficits who have cutaneous signs of occult spinal dysraphism, these tests must be performed. The treatment of patients with spinal dysraphism is difficult and necessitates close collaboration between specialists in neonatology, neurosurgery, plastic surgery, orthopaedics, urology, and rehabilitation.

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