



# Prospective Evaluation of Outcome and Surgical Management of Conus Lipoma in Eastern India

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## Abstract

**Background** Spinal lipomas are a group of spinal dysraphisms that most commonly present as closed spinal disorders associated with tethered cord syndrome. This is a pilot study spanning over 4.5 years, accounting for around 40 cases, aimed to conveniently study the demographic profile of the incidence, age, sex, clinical features, surgical outcome, complications, and follow-up of patients with conus lipomas. Also reviewed were the benefits and risks of prophylactic surgery as well as early versus late surgery.

**Methods** It is a prospective cohort study of review of the cases conducted over 4.5 years (between January 2019 and May 2023) at the Department of Neurosurgery, IMS and SUM Hospital, Bhubaneswar, Odisha, India, with a broad literature review done using search words “Conus” <AND/OR> “Spinal” <AND/OR> “Lipomas” spanning over academic articles indexed in PubMed, PubMed Central, NCBI, Embase, Scopus, and Google Scholar. A few home research articles written previously by a senior author of the current article were also cited. Data analysis was done using SPSS 22.0 for Windows for statistical computing.

**Results** There was a 1.2:1 male-to-female ratio. The most common age group of the patients ranged between 1 and 5 years. The commonest symptom was swelling in the lower back, and the commonest neurological involvement was motor deficit with bladder dysfunction, subjectively. Most patients remained neurologically intact postoperatively. CSF collection and urinary retention were the most common post-op complications observed.

**Conclusion** Symptomatic conus lipoma patients underwent surgery readily, given the deficits. However, looking into all the neurological deficits babies can develop in the long run, our study proposes prophylactic and early surgeries in even asymptomatic babies. However large-scale randomized trials should be undertaken to review the claim and advise accordingly.

## Keywords

- ▶ conus lipoma
- ▶ spinal dysraphism
- ▶ neurological deficits
- ▶ swellings of lower back

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## Introduction

Spinal lipomas include a group of spinal dysraphisms that are present most commonly as closed spinal disorders seen along with tethered cord usually.<sup>1</sup> It develops due to abnormal and deranged embryogenesis during the intrauterine period of 3 to 6 weeks when the formation of a neural tube occurs.<sup>2</sup> The disease most commonly presents during infancy and early childhood. The patients may be completely asymptomatic or may have ignored cutaneous stigmata. They may develop neurological deficits like motor weakness, bladder incontinence, scoliosis, and sensory defects in later stages. The primary management of choice for these lesions is surgery. However, the benefits and risks of prophylactic surgery for the same is controversial. There are proponents of early versus late surgery for this disease in their childhood.<sup>3</sup> The incidence of congenital spinal lipomas seen were approximately 4 to 8 per 1 million population.<sup>1</sup> Based on fat accumulation in the spinal canal, lipoma is broadly classified into six types (►Table 1), and as per size, lipomas can be classified into four types.<sup>4</sup>

We had an increased load of conus lipomas in our tertiary care hospital, with these cases constituting the second highest volume of visits. Our study aimed to conveniently study the demographic profile of the incidence, age, sex, clinical features, surgical outcome, complications, and follow-up of patients with conus lipomas. Also reviewed were the benefits and risks of prophylactic surgery as well as early versus late surgery.

## Methods

It is a pilot prospective cohort study conducted over 4.5 years (between January 2019 and May 2023) at the Department of Neurosurgery, IMS and Sum Hospital, SOA (Deemed to be) University, Odisha, India. Our hospital is a tertiary care 1,000-bedded teaching hospital located in Eastern India with approximately 50 to 75 beds dedicated to the Department of Neurosurgery. All the cases of conus lipomas admitted were included in the study. The incidence, age, sex, clinical features, surgical outcome, complications, and improvement or deterioration in patients surgically operated in our hospital were analyzed and a detailed tabulation of the same was compiled. Biopsied specimens were sent to the Department of Pathology in the same institute, and pathological diagnosis was the mainstay of diagnosis. A broad literature study was done

**Table 1** Chapman categorized conus lipoma types

Based on fat accumulation	Based on size (diameter)
Lipomeningomyelocele	Small (<3 cm)
Fatty filum	Medium (3–5 cm)
Intradural spinal lipoma	Large (6–10 cm)
Epidural lipoma	Giant (>10 cm)
Spinal angioliipoma	
Complex lipoma	

using search words “Conus” <AND/OR> “Spinal” <AND/OR> “Lipomas” spanning over academic articles indexed in PubMed, PubMed Central, NCBI, Embase, Scopus, and Google Scholar. A few home research articles written previously by a senior author of the current article were also cited. Data analysis was done using SPSS 22.0 for Windows, for Statistical Computing. All surgical outcomes were utilized in this case. The data sources used and assessments done in obtaining the variables selected in the study were hospital file records, ultrasonography (USG), radio-imaging, and electrophysiological studies of the patients.

## Results

Our senior author who has vast experience with such cases had operated 40 cases over the study span of 4.5 years. Our institutional experience that there was 1.2:1 male-to-female ratio ( $n=22$  vs. 18). The most common age group of the patients operated on was between 1 and 5 years ( $n=25$ ). All patients underwent surgery. The minimum age of conus lipoma operated on was 3 months and the maximum age was 12 years (►Table 2). The commonest symptom was swelling in the lower back, and the commonest neurological involvement was motor deficit with bladder dysfunction, subjectively and objectively examined ( $n=8$ ; ►Table 3). Most patients remained neurologically intact postoperatively. Cerebrospinal fluid (CSF) leakage ( $n=9$ ) and urinary retention ( $n=7$ ) were the most common postoperative complications seen (►Table 4). Bladder involvement did not improve after surgery (►Table 5). The transitional type of lesion developed more CSF leakage and pseudomeningocele.

## Discussion

The lipomyelomeningocele or the lipomas of the conus medullaris often presents with a skin marker or fatty mass in infancy or early childhood. It is often associated with spinal dysraphism and tethered cord syndrome (TCS).<sup>3</sup>

It is a disorder of primary neurulation that occurs around the third to sixth weeks of gestation. The neural groove begins forming in the center and keeps deepening. Neural folds become visible on either side of the groove, which gradually converge in the midline as time progresses. Ideally, it forms the ectoderm. In spinal lipomas, the cutaneous ectoderm fuses at the center, but the neuroectoderm fails to do so and, hence, is exposed. Thereafter, the exposed ectodermal surface of the neural tube induces differentiation of underlying mesoderm into

**Table 2** Demographic profile of conus lipoma patients

Total (40)	Male	Female	Types of lipoma (%)	
	22	18	Transitional	22 (55)
Age <1 y	1–5 y	>5 y	Dorsal	14 (37)
17	25	8	Caudal	4 (8)

**Table 3** Symptoms and respective proportion of patients

Symptoms	No. of patients (%)
Bladder and bowel only	4 (10)
Motor only	7 (17.5)
Motor plus sensory	2 (5)
Motor plus sensory plus bladder/bowel	8 (20)
Sensory only	0
Asymptomatic (prophylactic treatment)	19 (47.5)

**Table 4** Postoperative complications of conus lipoma

Complications	No. of patients
Surgical site infection (SSI)	3
Skin necrosis or dehiscence	4
Cerebrospinal fluid (CSF) leak	9
Pseudomeningocele	5
Neurological deterioration affecting motor and sensory functions	3
Urinary retention	7
Death	0

adipocytes, and a fatty mass (lipoma) grows subsequently. However, the fat origin hypothesis remains controversial.<sup>4</sup>

### Signs and Symptoms

Most of the patients are neurologically intact at birth. However, they gradually develop motor and sensory deficits without autonomic abnormalities. The symptoms develop during early childhood. Kumar et al concluded that neurological deficits were predominant in the older age group (mean of 6.2 years) compared with the younger age group in the neurologically intact patients (mean of 2.8 years).<sup>3</sup>

Pierre-Kahn et al also published a well-organized study that reported that the average age of the patients who presented with skin abnormalities was approximately 9 months.<sup>1</sup> Dorward et al also showed that the children presenting beyond 3 years of age were more likely to have

**Table 5** Follow-up of operated conus lipoma patients

Symptoms	Follow-up
Asymptomatic	No neurological deficits/deterioration in all 19 patients
Bladder and bowel symptoms	No improvement seen in any patient
Motor symptoms	2 patients showed mild improvement
Sensory symptoms	No improvement seen in any patient

neurological deficits as compared with younger children.<sup>5</sup> Kasliwal and Mahapatra also reported that the mean ages of patients with and without neurological deficits were 5.5 and 2 years, respectively.<sup>6</sup>

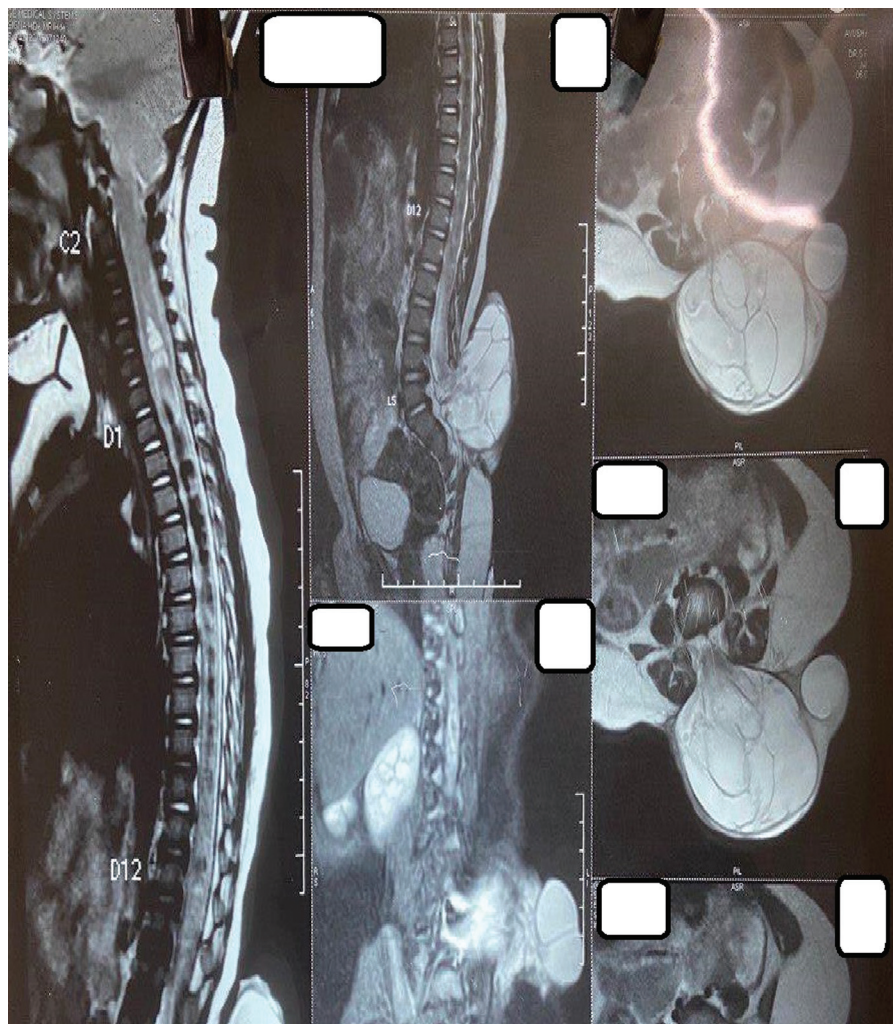
Few multifocal trophic healed ulcers were visible on the heel and medial portions of the feet only in five cases. The rest of the cases did not show any other trophic changes as it requires chronicity and most common cases are between 1 and 5 years and not as long-standing.

### Symptoms

- **Subcutaneous:** Lipomatous mass is seen in almost all patients at birth during the lumbosacral area. They may also occur as an occult mass.
- **Dermatologic:** An additional appendage, hair tuft, hemangioma, a dermal sinus (►Fig. 1), and a small dimple may be observed.
- **Appendicular:** Lower limb length discrepancies, muscle mass defects, and joint deformities.
- **Motor system:** Motor neuron deficits with progressive asymmetrical weakness.
- **Sensory system:** Patchy/differential loss of sensation.
- **Bowel and bladder:** Gradual deterioration of bladder functions with the age of the patient occurs. By 3 to 4 years of age, children develop neurogenic bladder, repeated urinary tract infections, and frank incontinence. But rectal incontinence is uncommon.<sup>4</sup>

**Fig. 1** Conus lipoma associated with dermal sinus.





**Fig. 3** Mosaic pattern terminal lipomyelocystocele.

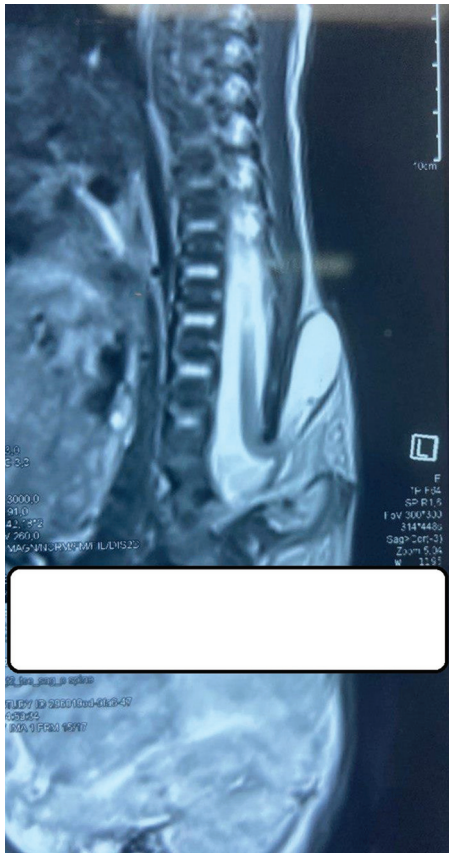
neurological deficits that the patient may develop in the future. Another debate is whether surgery improves neurological deficits or not. Surgical treatment for spinal lipomas is safe as reported in different studies.<sup>3,8</sup> In the study conducted by Kumar et al, none of the asymptomatic patients developed or deteriorated with any neurological deficit after surgery during follow-up.<sup>3</sup>

Few research evidence is questionable regarding the value of prophylactic surgery as it does not prevent the development of neurological deficit at later stages.<sup>9</sup> However, there are also opposing studies in the literature that are in favor of having prophylactic surgery. It is proposed to be safe and also found to halt the neurological deficit progression in the long term as compared with conservative treatment. Also, the earlier the surgery, the better the prognosis.<sup>3</sup>

There are a few setbacks of conservative management for asymptomatic patients with spinal lipomas. Required regular and detailed expert monitoring of the children may not be possible in economically weak, discontinuous infrastructure areas where even distance to specialist centers is a challenge. Also, it is required to have a neurosurgeon and urologist on call for emergencies. Visual

aesthetics are a major concern today and are to be considered and weighed accordingly. And performing surgery on patients after the development of neurological deficits never gives any beneficial results.<sup>3</sup>

In multiple studies, it has been reported that untethering of the cord can result in up to 60 to 65% improvement in bowel and bladder functions. Urological outcomes following conus surgery include urinary incontinence, recurrent need for clean intermittent catheterization (CIC), renal function deterioration, and requirement for bladder augmentation.<sup>10</sup> A study of 53 postsurgery patients showed 10 (19%) required CIC, 6 (11%) remained incontinent, 2 patients (4%) had kidney parenchymal damage detected by DMSA (dimercaptosuccinic acid) renal scan, and 2 (4%) needed bladder augmentation cystoplasty. Of the lipoma types, the transitional type had the worst outcomes concerning the need for CIC and urinary incontinence. There was no significant difference concerning kidney damage and bladder augmentation cystoplasty according to the lipoma type. No urological outcomes were found to be associated with the level of conus.<sup>16</sup>



**Fig. 4** Dorsal conus lipoma with a thick filum with a tethered cord.

From the Indian perspective, prophylactic surgery seems to be a better option as most patients rarely come for follow-up. This results in slowly deteriorating neurological symptoms. Operating a patient at late stages does not give good results as in early stage surgery.

## Conclusion

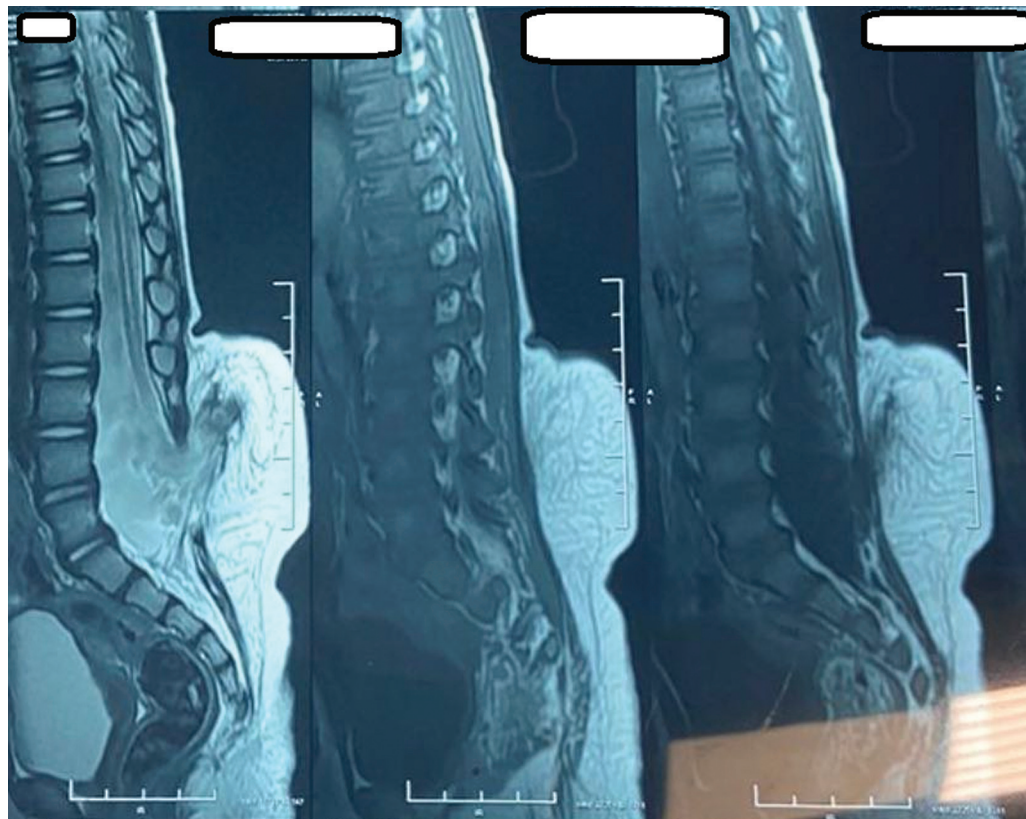
Symptomatic conus lipoma patients underwent surgery readily, given the deficits. However, looking into all the neurological deficits babies can develop in the long run, our study proposes prophylactic surgeries in even asymptomatic babies. However, large-scale randomized trials should be undertaken to review the claim and advise accordingly.

## Limitations of the Study

The study is limited to a single-center small sample size of 40. A longer prospective follow-up for more detailed benefit-to-risk ratio of prophylactic versus postsymptomatic and early versus late surgery needs to be studied.

## Authors' Contribution

A.A. drafted the original manuscript, S.P. reviewed the literature, S.B.S. compiled the results, A.K.M. revised the final draft and conclusion, and R.C.D. prepared the figures and tables, and S.P. and S.T. finalized the manuscript.



**Fig. 5** Transitional lipoma.

**Conflict of Interest**

None declared.

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