

A dermal sinus tract is a form of occult spinal dysraphism. Embryologically, it results from a focal incomplete disjunction of the surface ectoderm and dermal elements from the neuroectoderm. This process likely occurs between the third and eighth weeks of gestation. Later during embryogenesis, the spinal cord ascends relative to the spinal canal and stretches the adhesion cephalad into a long, tubular tract. Dermal sinus tracts are therefore abnormal communications extending from the skin surface to the spinal fascia, dura mater, or neural elements, and are lined with epithelium. Although dermal sinuses can occur anywhere from the upper cervical region to the midsacrum, they are most commonly found in the midline in the lumbar or lumbosacral area. Some dermal sinuses end blindly within the soft tissues superficial to the underlying lamina, but 60–70% reach the subarachnoid space, half attaching to the filum or the conus.

## 50.1 Diagnosis

A dermal sinus usually manifests as a small dimple or pinpoint ostium, which is often associated with cutaneous findings of hyperpigmentation, hypopigmentation, angiomatous skin changes, hypertrichosis, subcutaneous lipomas, or drainage of debris or fluid from the pit. They occur in the midline or rarely in a paramedian location.

Dermal sinus tracts include both dermal and epidermal elements, and may be associated with CSF leakage, intradural dermoid or epidermoid cysts, spinal cord tethering, or (rarely) teratomas. Diagnosis may be aided by ultrasound (usually up to 6 months of age) or MRI. Ultrasonography readily demonstrates the subcutaneous tract, intraspinal inclusion tumours, and diminished cord pulsations. MRI,

including T1-weighted sagittal and axial MRI with gadolinium injection and fat saturation, is the gold-standard diagnostic technique.

Clinical and radiologic features can appear innocuous, leading to delayed diagnosis and failure to appreciate the extent of the abnormality. If the dermal sinus is left untreated, the main complication is infection, with meningitis or intradural abscesses. These infections may lead to permanent neurologic deficits, so dermal sinuses must be diagnosed and operated on early in life. The entire midline area of the skin from the skull to the sacrococcygeal region must be carefully inspected when a child of any age suffers recurrent meningitis or meningitis from an unusual organism. A high index of suspicion must be maintained for all dimples above the intergluteal fold despite a normal examination or neuroradiologic studies. Other common presenting symptoms include those of tethered cord, spinal cord compression secondary to intradural dermoid cyst growth, and hydrocephalus secondary to recurrent meningitis.

Dermal sinuses must be differentiated from benign coccygeal pits, which end blindly and never extend intraspinally, and therefore do not require further imaging evaluation or treatment. Dermal sinus tracts are found above the natal cleft and are usually directed superiorly. By comparison, coccygeal pits are found within the natal cleft, below the top of the intergluteal crease, with a tract extending either straight down or inferiorly. Coccygeal pits occur over the lower sacrum and coccyx and are anatomically located below the level of the subarachnoid space. They are encountered in nearly 5% of newborns, and although they are present from birth, they rarely manifest themselves before adult life. In later years, these small pits or dimples may become pilonidal sinuses or abscesses.

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J. R. Ellenbogen (✉) · C. L. Mallucci  
Department of Neurosurgery, Alder Hey Children's NHS  
Foundation Trust, Liverpool, Merseyside, UK  
e-mail: [jellenbogen@doctors.org.uk](mailto:jellenbogen@doctors.org.uk)

## 50.2 Treatment

Dermal sinuses should be electively resected at the time of diagnosis, regardless of patient age. Conservative management of dermal sinuses is not justified because of the potential for complications resulting in meningitis and permanent neurologic dysfunction. General procedure-related morbidity is acknowledged to be very low, with postoperative infection being the most common complication.

### 50.2.1 Elective Resection

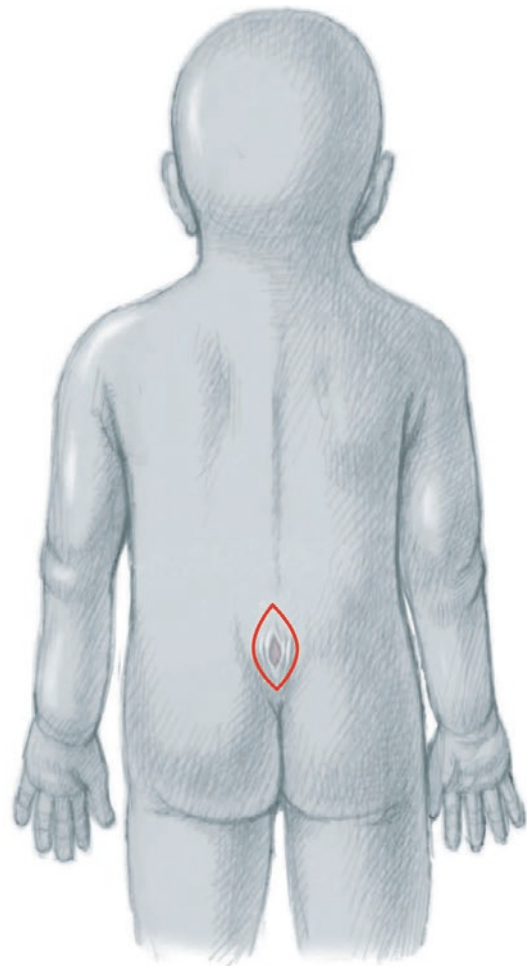
Treatment of these lesions consists of excision of the dimple and the tract, as well as any intradural connections or masses. Even when MRI reveals no intradural anomalies, dermal sinus tracts located above the gluteal crease should be explored to their termination. Surgery in advance of deficits aims to maintain normal neurologic function, allowing these children to develop unimpeded by infection or by motor or bladder paralysis.

After induction of general anaesthesia and placement of a Foley catheter into the bladder, the patient is positioned prone with lateral padded rolls supporting the chest and abdomen. The arms of children less than 2 years of age are best supported alongside the trunk, whereas in older patients, elevation above the shoulder positions the surgeon closer to the patient. Chlorhexidine solution is used to prepare the skin from the intergluteal fold to many spinal levels above the sinus tract. Perioperative administration of intravenous antibiotics is strongly recommended. An elliptical skin incision encircling the sinus opening, and any abnormal skin surrounding it, is made to excise fully the dermal sinus (Fig. 50.1). Purulent material or drainage should be cultured in aerobic and anaerobic medium.

The subcutaneous tissue is divided to expose the fascial defect, and the sinus stalk is circumferentially dissected (Fig. 50.2). Cephalad to the stalk, the paraspinal muscles are elevated with electrocautery in a subperiosteal fashion from the first intact spinous process and lamina. Preparations must be made to continue bone removal across several laminae until the site of attachment to the dura is identified.

If imaging studies or intraoperative observation indicate that the lesion penetrates deeper than the fascia, the dissection should proceed along the tract until its termination is reached.

The dura is opened with an elliptical incision encompassing the tract. Some sinus tracts abruptly end with dural attachment, which is readily apparent after dural opening. In these cases, after confirming normal intradural anatomy, the dura is closed and the wound is closed in layers. When the stalk continues and intradural lesions such as a dermoid or epidermoid cyst or tethered spinal cord are present, then the



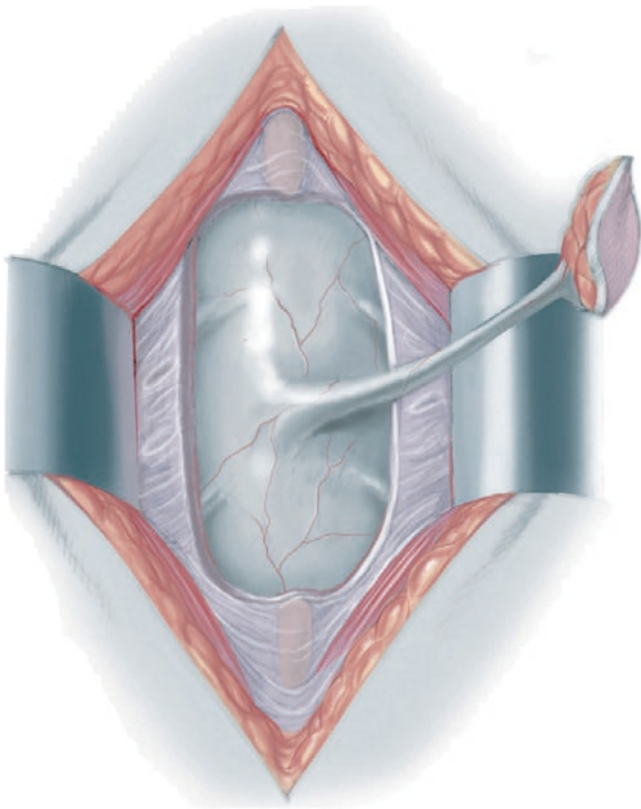
**Fig. 50.1** Skin incision encircling the sinus opening

dissection must proceed into the intradural space (Fig. 50.3). Further dissection is performed with loupe or microscope magnification. Dissection of the stalk from this disordered glial mass may be accomplished using sharp microsurgical technique.

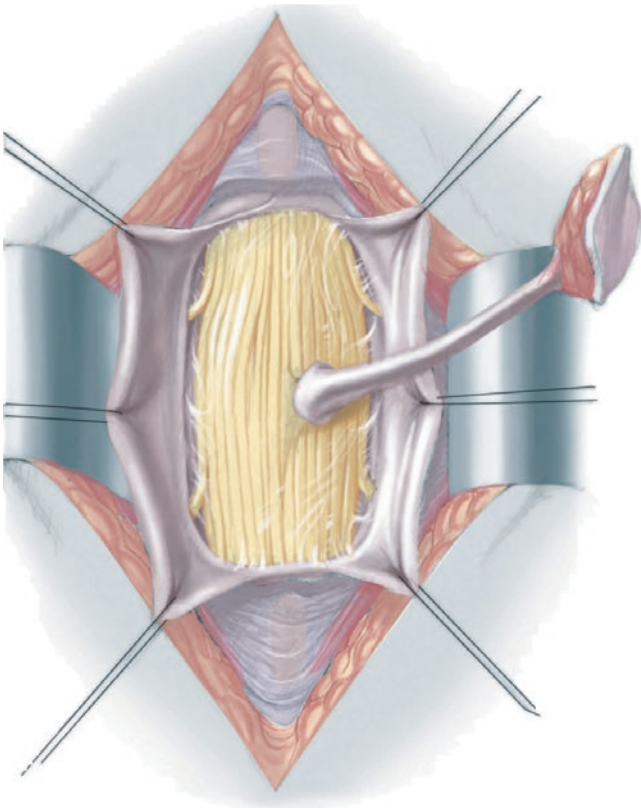
Intra-operative ultrasonography may be useful for identifying syringomyelia or intramedullary dermoid at the site of stalk attachment.

Regardless of the attachment anatomy, a comprehensive inspection should be carried out to look for arachnoid adhesions, dermoid tumours, and a thickened filum terminale (Fig. 50.4). Dermoid inclusion tumours are frequently multiple and can be solidly adherent to the filum and nerve roots within the cauda equina, especially when meningitis has occurred.

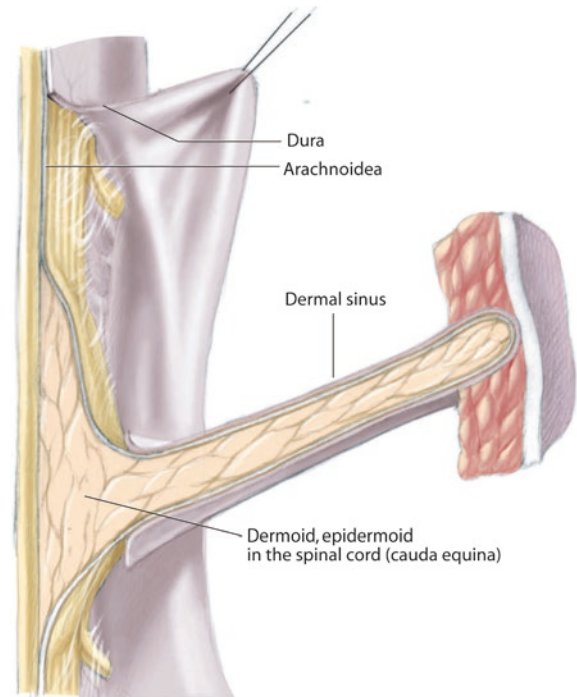
Intradural cysts should be completely removed, without opening if this is possible and does not endanger neural elements. Intraspinous and adherent intradural cysts are emptied of their contents and as much as possible is



**Fig. 50.2** Exposure of the fascial defect and dissection of the sinus stalk



**Fig. 50.3** Dissection into the intradural space



**Fig. 50.4** Cross-sectional anatomy

removed, but attempting to remove a hard fibrous capsule densely adherent to neural tissue or a capsule of infected intraspinal cysts is fruitless and may lead to avoidable cord or root injury. Duraplasty is performed if necessary, and the muscles and skin are closely approximated without drainage. Drainage of an extradural abscess after operation may be necessary.

Debulking dermoid cysts from within is the method of choice. The capsule, which may be adherent, can usually be dissected from the surrounding neural elements. Retention of an epithelial surface will result in recurrence of the dermoid cyst and necessitate a repeated operation. An attempt to remove the capsule should be undertaken to prevent further recurrence of the lesion. The initial dissection has the highest likelihood of achieving complete resection. Incompletely resected dermoid tumours may grow slowly over time, and the density of postoperative adhesions and scar preclude total resection at reoperation. Intraoperative neurophysiology monitoring may be useful for complex intradural cases with adherent nerve roots, to avoid any new nerve root injury.

Following complete tract and inclusions tumour resection, the subarachnoid space should be irrigated with a saline solution. Dermoid and epidermoid debris are highly irritative to the spinal fluid, and this manoeuvre may diminish postoperative inflammatory meningitis. If an intramedullary mass has been resected, the pia arachnoid might be sutured and the tubular spinal cord reconstituted.

To minimize postoperative spinal cord tethering, a dural patch graft can be incorporated to ensure a wide contact of cerebrospinal fluid around the lower spinal cord and cauda equina. Fibrin glue may be employed if necessary. The wound is closed in layers, and the paraspinal muscle fascia is reapproximated with running and interrupted sutures in a watertight manner. Skin closure with vertical mattress sutures is preferred, especially if there has been previous infection.

### 50.2.2 Emergency Surgery

If the lesion is discovered during an episode of meningitis, laminoplasty and intradural exploration should follow after the infection has been controlled by antibiotic therapy. Emergency surgery is required in cases of rapid neurologic deterioration, recurrent infection during antibiotic therapy, or when infection cannot be controlled quickly.

Surgical treatment consists of excision of the dimple and the tract from the skin surface to the deepest projection, including intradural connections or masses. Intradural exploration is warranted, as it may reveal previously unappreciated pathologic findings even when MRI findings are unremarkable.

## 50.3 Outcomes

The prognosis in patients who already have some neurologic deficit is frequently unfavourable, although some improvement may occur in most patients. Surgery is performed to prevent neurologic deficit in those who do not have it. In patients with incomplete tumour resection, follow-up MRI is recommended at least yearly.

Optimum management of children requires close cooperation among the multidisciplinary team encompassing paediatricians, paediatric surgeons, neurosurgeons, and the multiple specialists involved with congenital disorders and infectious diseases.

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## Suggested Reading

- Albright AL, Pollack IF, Adelson PD. Principles and practice of pediatric neurosurgery. 3rd ed. New York: Thieme; 2015.
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- Zerah M, Kulkarni AV. Spinal cord malformations. In: Dulac O, Lassonde M, Samat HB, editors. *Pediatric neurology, Part II: Handbook of clinical neurology*. Amsterdam: Elsevier BV; 2013. p. 975–91.