Intramedullary Spinal Cord Abscess among Children

Subjects: Infectious Diseases

Contributor: Bartosz Szmyd , Redwan Jabbar , Weronika Lusa , Filip Franciszek Karuga , Agnieszka Pawełczyk , Maciej Błaszczyk , Jakub Jankowski , Julia Sołek , Grzegorz Wysiadecki , R. Shane Tubbs , Joe Iwanaga , Maciej Radek

Intramedullary spinal cord abscesses (ISCA) are rare. Typical symptoms include signs of infection and neurological deficits. Symptoms among (younger) children can be highly uncharacteristic. Therefore, prompt and proper diagnoses may be difficult. Typical therapeutic options include antibiotics and neurosurgical exploration and drainage.

intramedullary spinal cord abscess | ISCA | abscess | spinal cord tumor

1. Introduction

The intramedullary spinal cord abscesses (ISCAs) remain a rare, albeit widely publicized entity since the first reported case in 1830 [1][2][3]. Their rarity may be explained by the following factors: (1) the small volume of the spinal cord compared to the brain, (2) the small area of the spinal canal and acute angle of origin of the spinal arteries, and (3) the protected condition of the cord within the vertebral canal (see **Figure 1**) [3].

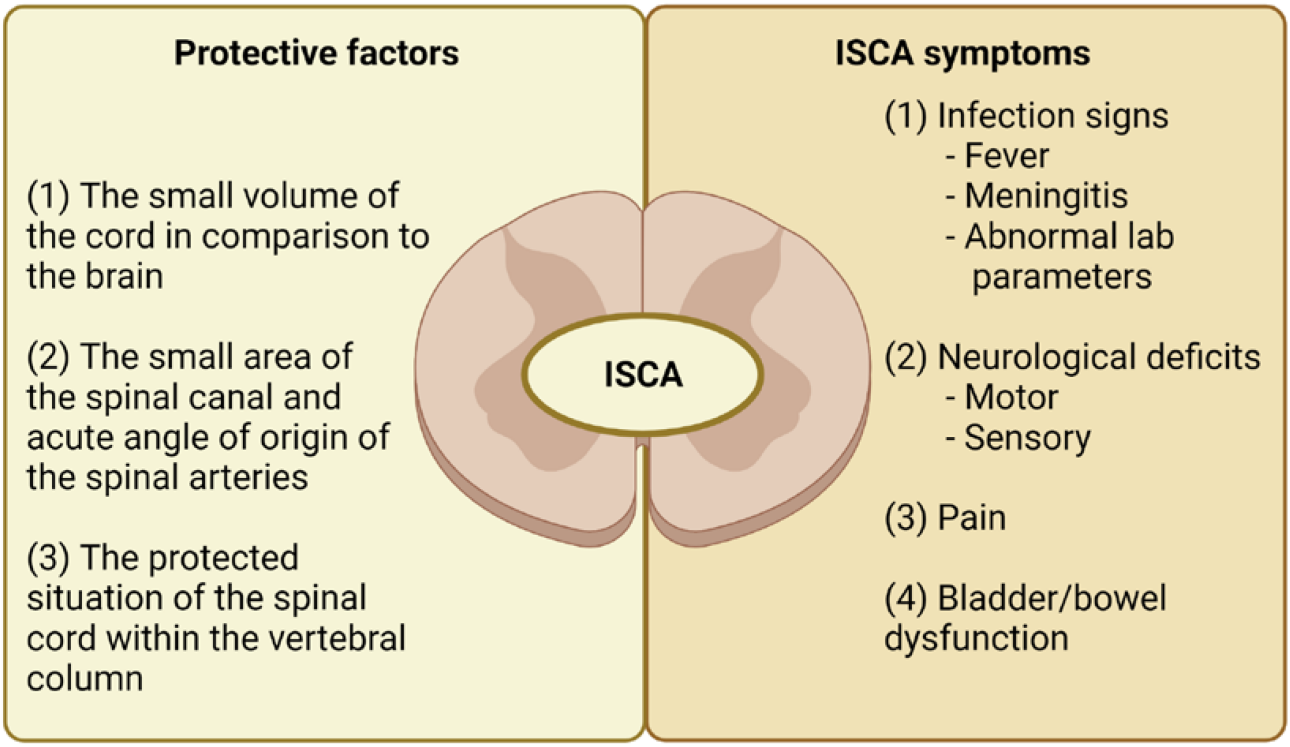

Figure 1. The protective factors and typical symptoms of intramedullary spinal cord abscess. Legend: ISCA — intramedullary spinal cord abscess.

The typical symptoms include infection signs (fever/meningitis), neurological deficits (motor and/or sensory), and also pain (see **Figure 1**). These symptoms among children, especially younger ones, can be highly uncharacteristic and regrettably, can be associated with significant mortality. Therefore, a rapid and proper diagnosis may be difficult. Typical therapeutic options include antibiotics and neurosurgical exploration and drainage [4].

2. What Is Currently Known about Intramedullary Spinal Cord Abscesses in Children?

This diagnosis of ISCA was confirmed in 37 (57.81%) boys and 25 (39.06%) girls. In two cases (3.13%), there were no data regarding sex. The analyzed ages did not reveal a normal distribution (Shapiro–Wilk test; $p < 0.001$; see **Figure 2**). The median age of the patients was 2.00 years (IQR: 1.17–5.00). Boys were significantly older than girls: 3.60 (IQR: 1.42–6.00) vs. 1.33 (IQR: 1.00–2.25; $p = 0.007$).

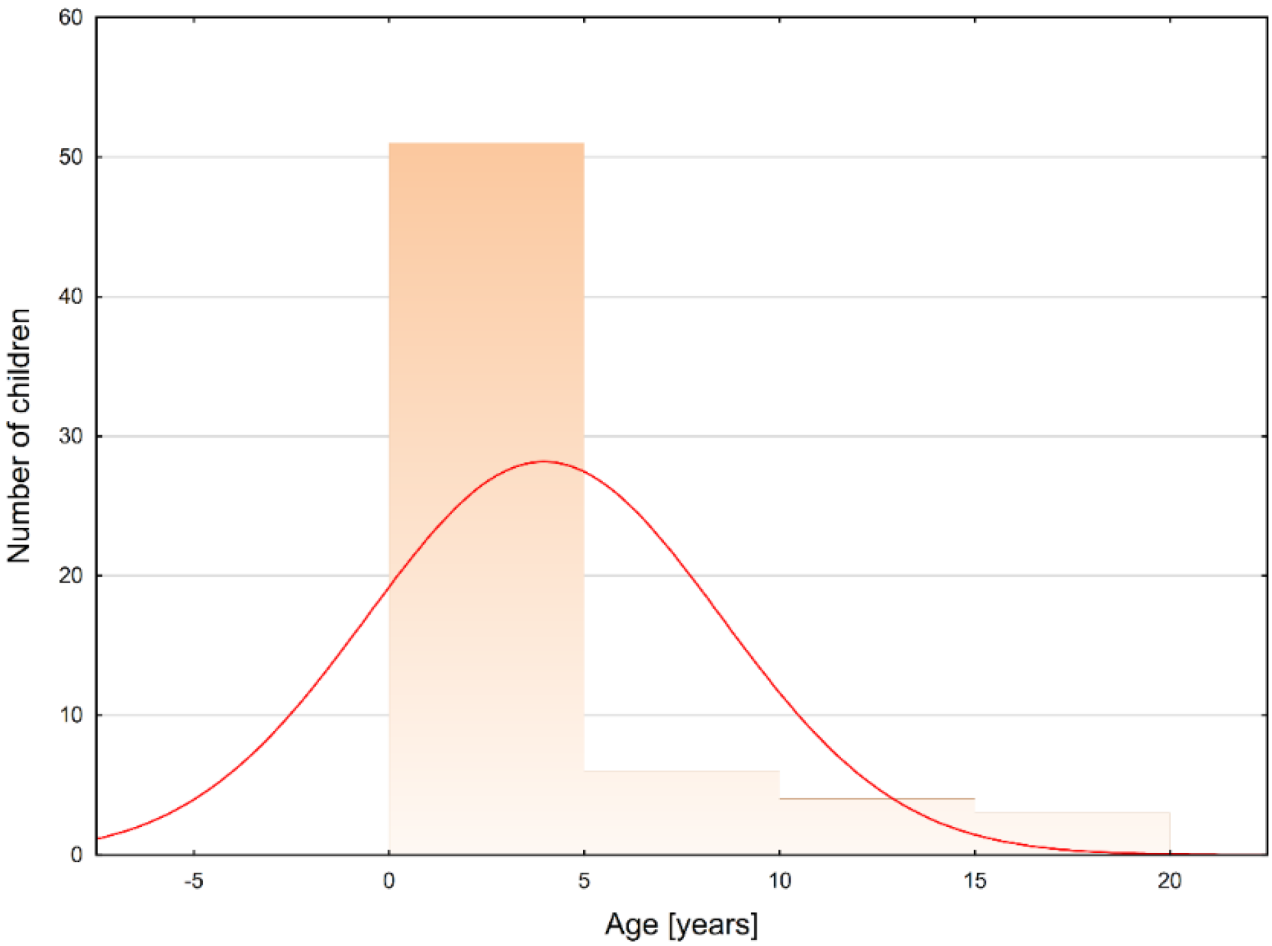

Figure 2. The age distribution among pediatric patients who developed intramedullary spinal cord abscesses (Shapiro−Wilk test: $p < 0.001$). Legend: red curve − expected normal distribution.

2.1. ISCA Course and Localization

The course of ISCA can be divided into acute (<1 week), subacute (1–6 weeks), and chronic (>6 weeks) [5]. The most frequently observed manifestation was acute: 25 (39.06%) followed by 21 (32.81%) subacute cases. Chronic onset was observed in 13 (20.31%) cases. In five (7.82%) cases there were no detailed data. Neither sex ($p = 0.350$) nor age ($R = -0.010$, $p = 0.940$) affected the onset of ISCA.

The exact location was identified in 60 cases (including seven holocords and two isolated lesions in the conus medullaris). The location of ISCA lesions in the remaining 51 cases is shown in **Figure 3**. The precise localization was not directly provided in four of the cases. In the newborn/infant group the spinal cord terminated most frequently at the level of L2/L3. As we age, the level of spinal cord termination is changing, and in the adolescent population, it was most often found at the level of the middle third of L1 and L1/L2 [6]. Therefore, it seems to be interesting that in 16 (25%) cases the abscess was observed below the L3 level. The possible reasons for these observations were found in 12 (75%) cases. There were distinguished the following causes: five (31.25%) cases of spina bifida, four (25.0%) cases of (possible) coexistence of ISCA and intradural extramedullary lesion, two (12.5%) cases of low conus medullaris. Moreover, researchers identified one case of the following explanation: retained medullary cord [6], tethered cord [7], and mild thoracolumbar scoliosis with upper anal cleft [8]. Theoretically, the classification of the lesion within the terminal filum may be the next issue. Lesions in this localization are considered *intraspinal,* which may be in contradiction to the aforementioned end of the spinal cord.

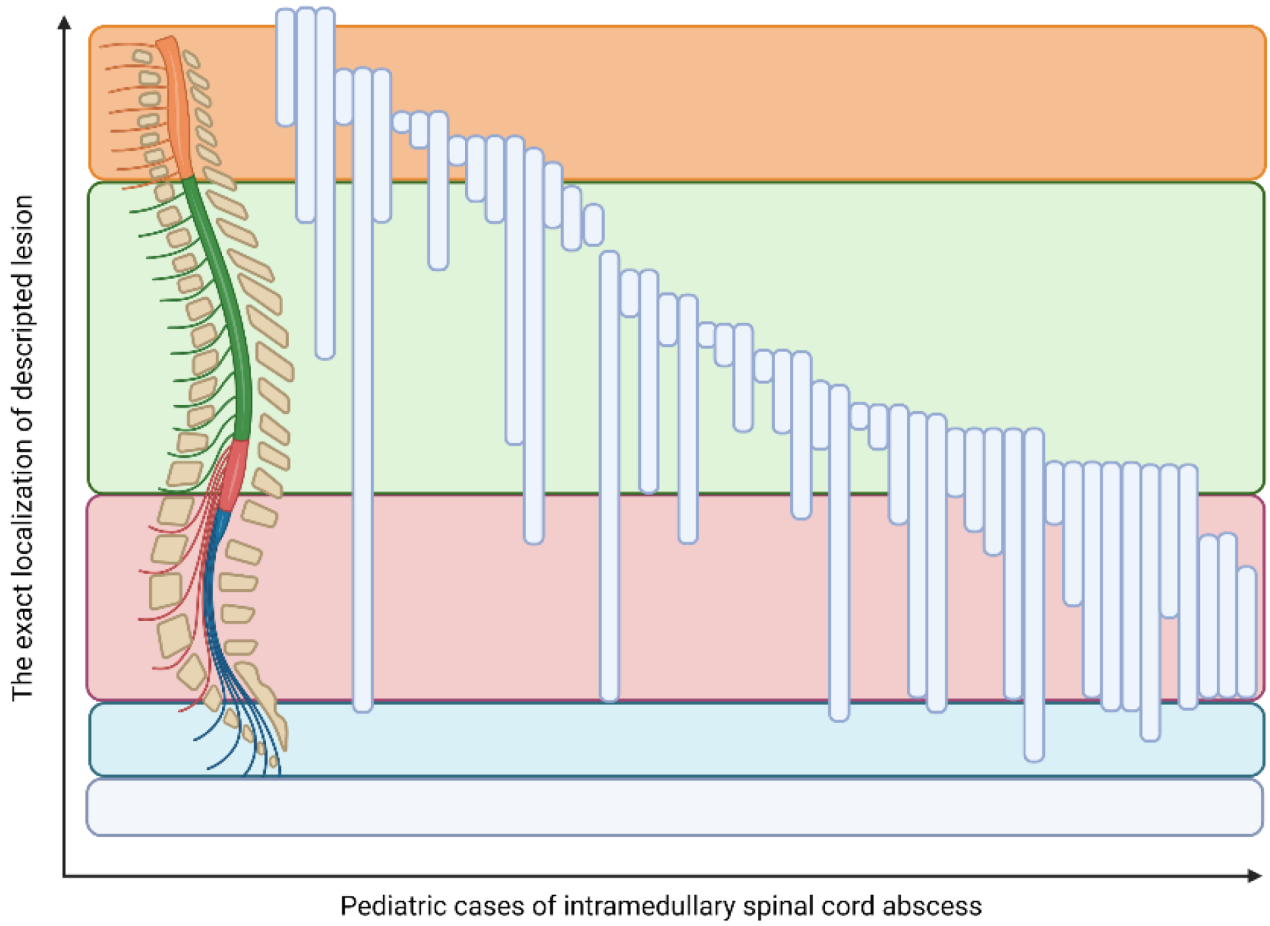

Figure 3. The localization of the intramedullary spinal cord abscess in children.

2.2. Symptoms Present in ISCA Patients

Laboratory results indicative of inflammation/infection were identified in 55 (85.94%) patients. These included fever—39 (60.94%), abnormalities in laboratory tests (elevated white blood cell counts, C-reactive protein concentration, and erythrocyte sedimentation rate)—34 (53.13%), and symptoms of meningitis—12 (18.75%). Motor deficits were observed in 57 (89.06%) patients.

In the other cases, the following symptoms were noted, e.g., irritability, exaggerated lower and upper limb reflexes, and isolated fevers. Sensory deficits were noted in 25 (39.06%) patients. Moreover, urinary and bowel dysfunction were observed in 28 (43.75%) and 11 (17.19%) cases, respectively.

2.3. Predisposing Factors and Comorbidities

2.3.1. Dermal Sinus Tracts

Congenital midline defects, as well as anatomic abnormalities of the spinal cord or vertebral column, are some of the key predisposing factors for ISCA. One of these is dermal sinus tracts (see **Figure 4**), an abnormality present at birth over the dorsal midline where an abnormal epithelialized connection from the skin tracks inwards toward

the spine, especially in the lumbar (32–43%) and the lumbosacral regions (32–54%) [9]. Their prevalence is estimated at 1 in 2500 live births.

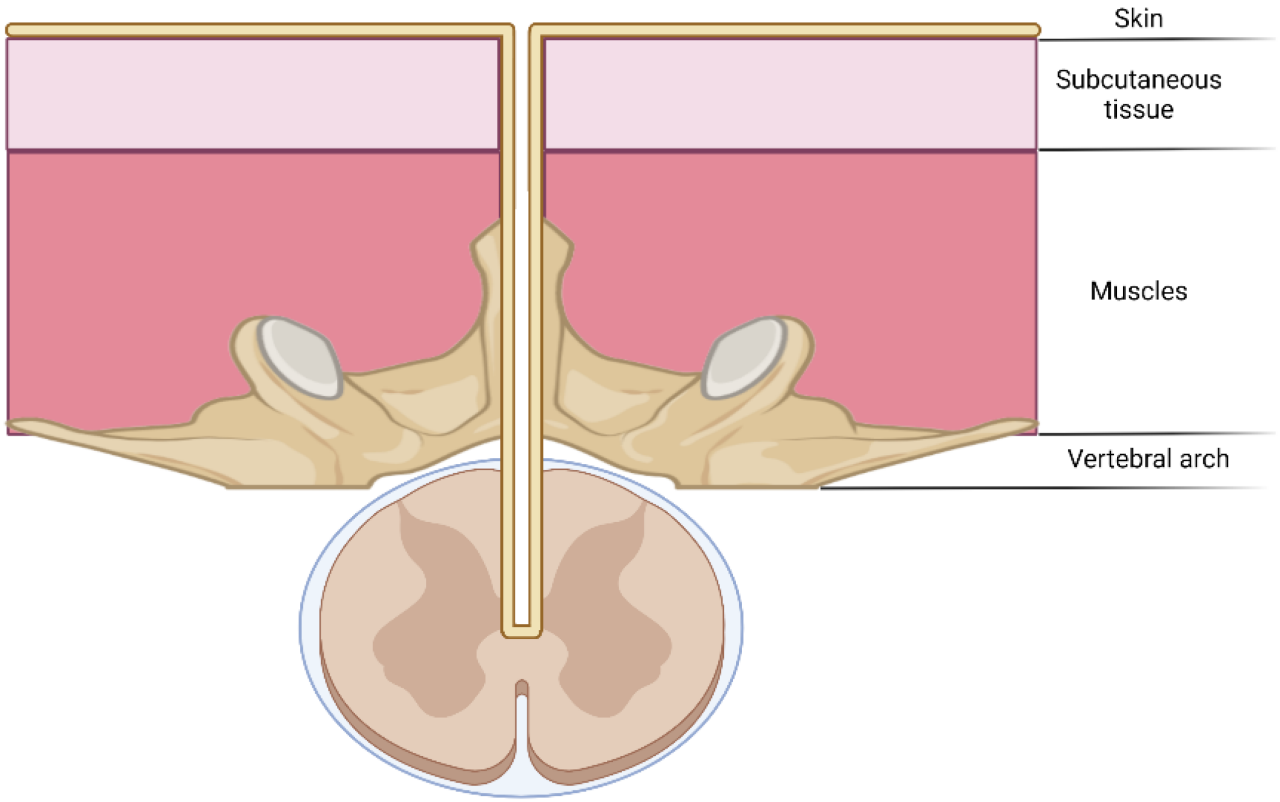

Figure 4. The schematic representation of a dermal tract as a predisposing factor for intramedullary spinal cord abscesses.

Dermal sinus sinuses were observed in 35 (54.68%) children. The causative organisms among these patients include the microorganisms colonizing the skin surrounding the sinus tract openings [10].

2.3.2. (Epi)dermoid Cyst

Epidermoid and dermoid cysts are two major variants of ectodermal-derived neural axis cysts [11]. Here researchers found three cases of this condition in ISCA patients [11][12][13]. Interestingly, these pathological entities can be related to a dermal sinus tract it is not mandatory [11].

2.3.3. Spina Bifida

Researchers identified nine cases of ISCA related to spina bifida (see **Figure 5**) [7][12][14][15][16][17][18][19]. In almost all of these cases, the presence of dermal sinus tracts was noted. Therefore, it should be assumed, that the true predisposing factor, dermal sinus tracts, is more frequently observed among patients with abnormalities of the ectodermal, mesenchymal, or neural crest derivatives such as myelomeningocele, lipomylomeningocele, and other forms of spina bifida occulta [15]. Perhaps a similar explanation can be given in the case of ISCA among adult patients born with talipes equinovarus [20][21].

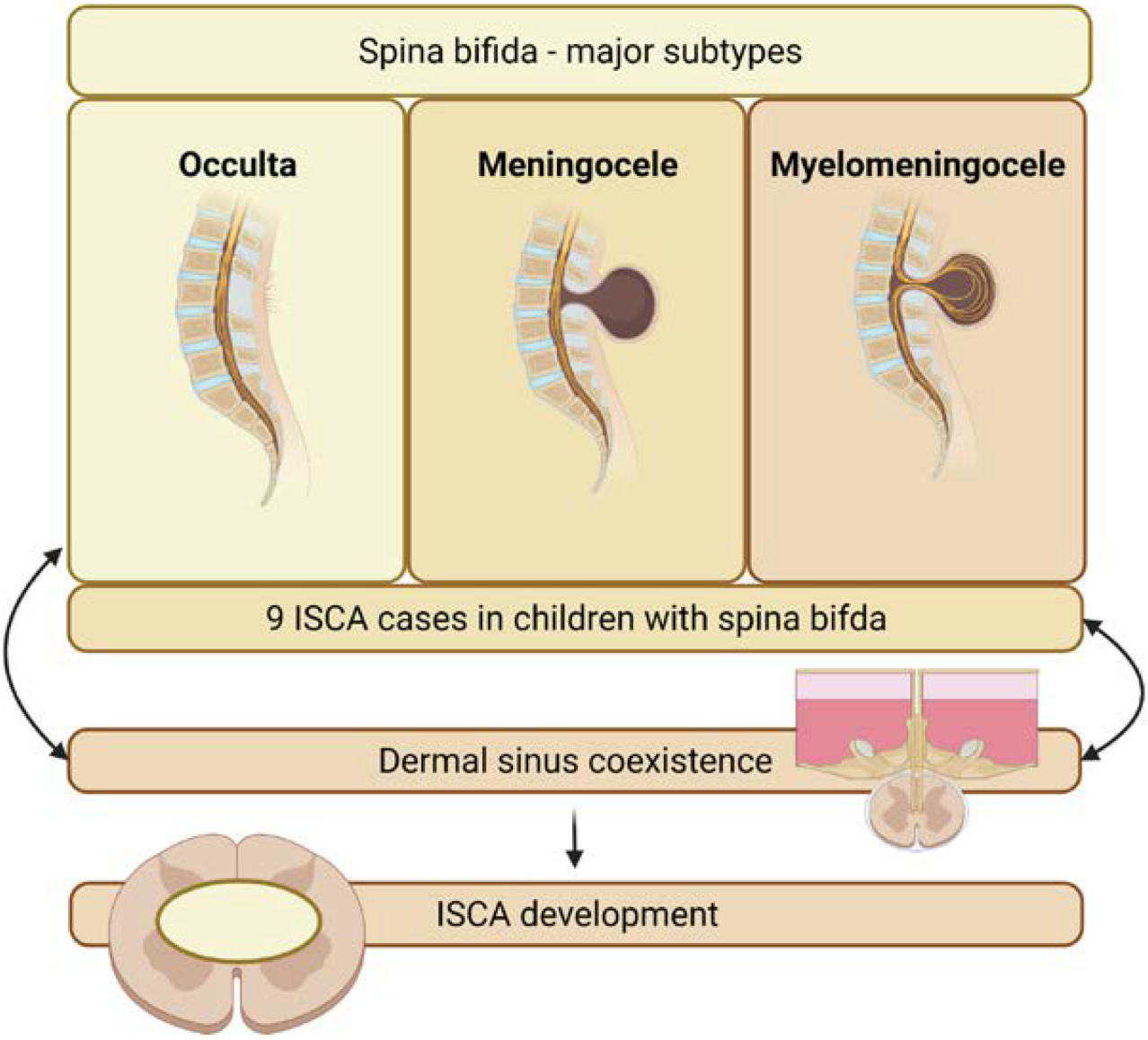

Figure 5. Relationship between spina bifida and intramedullary spinal cord abscess.

2.3.4. Prior Inflammation

Prior inflammation is a risk factor for developing ISCA. It may lead to a hematogenous or contagious spread of infection. The following scenarios were observed: general infection [22][23], respiratory system infection [24], maxillary sinus abscesses [25], Brucella infection [26], and long-term diarrhea [27]. Interestingly, there were noted some cases of previous tuberculosis [25].

2.3.5. Others

Other risk factors included iatrogenic ones as well as trauma. In the literature search, researchers have identified one case of ISCA which developed in the course of multiple attempts to perform a lumbar puncture and a second one due to spinal cord injury [28][29].

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