**ONLINE APPENDIX**

**Search Strategy**

*MEDLINE*

1. Tarlov Cysts/

2. Sacrococcygeal Region/ or Spinal Nerve Roots/ or Sacrum/

3. Cysts/

4. 2 and 3

5. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

6. 1 or 4 or 5

7. limit 6 to (english or french)

8. limit 7 to animals

9. limit 7 to (animals and humans)

10. 8 not 9

11. 7 not 10

*PubMED*

1. Tarlov Cysts/

2. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

3. 1 or 2

4. limit 3 to (english or french)

5. limit 4 to animals

6. 5 not 4

*Cochrane CENTRAL Register of Controlled Trials Nov 2015*

1. Sacrococcygeal Region/ or Spinal Nerve Roots/ or Sacrum/

2. Cysts/

3. 1 and 2

4. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

5. 3 or 4

6. limit 5 to (english or french)

7. limit 6 to animals

8. limit 6 to (animals and humans)

9. 7 not 8

10. 6 not 9

*EMBASE*

1. Tarlov cyst/

2. cyst/

3. sacral spinal cord/

4. "spinal root"/

5. 3 or 4

6. 2 and 5

7. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

8. 1 or 6 or 7

9. limit 8 to (english or french)

10. limit 9 to animal studies

11. limit 9 to (human and animal studies)

12. 10 not 11

13. 9 not 12

*PsycINFO*

1. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

2. limit 1 to (english or french)

*Cochrane Database of Systematic Reviews Dec 2015*

1. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

2. limit 1 to (english or french)

*HTA Database 4th Quarter 2015*

*CRD HTA Database*

1. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) adj5 cyst\*).tw.

2. limit 1 to (english or french)

*CINAHL*

1. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) N5 cyst\*)[Title/Abstract]
2. (MH "Cysts")
3. (MH "Spinal Nerve Roots") OR (MH "Sacrum")
4. 2 and 3
5. 1 or 4

CINAHL Database: 78 records

*SOCIndex*

1. ((meningeal or perineural or perineurial or sacral nerve\* or sacral root\* or sacrum or tarlov\*) N5 cyst\*)[Title/Abstract]

Table 1: Detailed Characteristics of Studies Included in Clinical Effectiveness/Safety Systematic Review

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Author, Reference, Year of Publication,*  *Country* | *Patient Selection* | *Research methods* | *Key findings* | *Safety* |
| Ahmed28,  2006,  Saudi Arabia | **Total number of patients:** 11  **Patient Selection**: Surgical admission at Benha University Hospital and King Fahd Hospital from 1997 to 2002.  **Inclusion Criteria:** Diagnosis of lumbosacral perineural cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Eleven participants (7 females and 4 males) with mean age of 32 years (range 23-45) were included. Cysts were located between L3 and S2.  **Symptoms prior to treatment**: Unilateral sciatica (n=7), bilateral sciatica (n=4), weakness (n=4), night pain (n=11), and urinary disturbance (n=3) | **Study Design:** Case series  **Intervention(s)**: Laminectomy (n=8) or hemilaminectomy (n=3)  **Comparator (if applicable):** None  **Follow-up time:** Mean follow-up of 25 months (range 3-60 months) | * The authors concluded that surgical results were excellent in eight participants and good in three. The authors recommend it as a choice of surgical treatment. * There was no recurrence of symptoms or regrowth of cyst during follow-up time. | Adverse events from intervention:  None |
| Asamoto29,  2013,  Japan | **Total number of patients:** 10  **Patient Selection**: Not reported  **Inclusion Criteria:** Diagnosis ofTarlov Cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Ten participants (four females, 6 males) with a mean age of 42.1 (range 18-56) were included.  **Symptoms prior to treatment**: Sciatica (n=10), bowel sphincter dysfunction (n=2), and motor weakness of the lower extremities (n=2), coccydynia (n=3), leg hypesthesia (n=10). | **Study Design:** Case series  **Intervention(s)**: Surgery  **Comparator:** None  **Follow-up time:** Range from 6-15 years. | * No patients had any regrowth of cyst | Adverse events from intervention:   * One patient experienced subcutaneous leakage of cerebrospinal fluid two weeks after surgery, which resolved within four weeks. |
| Béraud12,  1967,  Canada | **Total number of patients:** 2  **Patient Selection**: Not reported  **Inclusion Criteria:** Diagnosis ofTarlov cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Two patients, one 46-year-old woman with an S2 cyst, one 57-year-old woman with an S2 cyst 3cm long and 2.5cm in diameter  **Symptoms prior to treatment**: lumbar pain (n=1), lombosciatica (n=1) lower body pain (n=1), pollakiuria (n=1) | **Study Design:** Case series  **Intervention(s)**: Surgery, laminectomy and complete removal of cyst  **Comparator (if applicable):** None  **Follow-up time:** 2 months in both cases | * Symptoms completely eliminated in both cases | Adverse events from intervention:  None |
| Cantore6,  2013,  Italy | **Total number of patients:** 19  **Patient Selection**: Individuals who were treated in two hospitals in Rome between 1986 and 2011 were eligible for inclusion  **Inclusion Criteria:** Diagnosis of Tarlov Cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Nineteen participants (14 female, 5 male) with a mean age of 45.4 years old (range: 16-67 years) were included. Participants had symptoms for an average of 8.6 months prior to inclusion (range: 1 month to 3 years)  **Symptoms prior to treatment**: Leg pain (n=5), urinary dysfunction (n=15), perianal and perineal pain (n=10). | **Study Design:** Case series  **Intervention(s)**: Surgery: Cyst remodeling by titanium clips  **Comparator:** None  **Follow-up time:** Average of 122.6 months (range: 9 months to 25 years) | * Sixteen participants (84.3%) experienced complete or nearly complete relief from symptoms, after surgery * Eleven of fifteen participants with urinary dysfunction had resolution of symptoms after surgery * Eleven of fifteen participants with pain reported complete relief after surgery | Adverse events from intervention:   * None |
| Caspar19,  2003,  Germany | **Total number of patients:** 15  **Patient Selection**: Consecutive individuals presenting with symptomatic sacral cysts between 1992 and 2001 were eligible for inclusion.  **Inclusion Criteria:** Symptomatic sacral cysts  **Exclusion Criteria:** None reported  **Patient Characteristics:** Fifteen patients (gender unknown) with a mean age of 45 years (range 18-62) were included. Cysts were 1-6 ml, and all were located between S1 and S3.  **Symptoms prior to treatment**: persistent back pain (number not reported), sciatic pain (number not reported). | **Study Design:** Case series  **Intervention(s)**: Microsurgical treatment  **Comparator (if applicable):** None  **Follow-up time:** Mean follow-up 60 months (range 6-108 months) | * Thirteen out of fifteen patients experienced complete or substantial resolution of the preoperative local and radicular pain after surgery. * Two patients with motor deficits and six patients with bladder dysfunction recovered * The authors found no cyst regrowth or symptom recurrence during follow-up. | Adverse events from intervention:  None |
| Guo23,  2007,  China | **Total number of patients:** 11  **Patient Selection**: Treated at Tongji Hospital, Huazhong University of Science and Technology from 1993 through 2006  **Inclusion Criteria:** Symptomatic sacral perineurial cysts who underwent microsurgical treatment  **Exclusion Criteria:** None reported  **Patient Characteristics:** Eleven patients (six men, five women) with a mean age of 36.7 years (range 28-44). Patients had 1-3 cysts that were 1-6cm, and were located between L3 and S3. Participants had symptoms from 2 weeks to 10 years in duration.  **Symptoms prior to treatment**: local back pain (n=7), sacrococcygodynia (n=9), numbness (n=6), nerve root radical pain or sciatic pain (n=4), sensory and motor disturbance of the lower extremities (n=7), decreased deep and superficial reflex (n=3), claudication (n=4), and bowel and bladder dysfunction (n=4). | **Study Design:** Retrospective case Series  **Intervention(s)**: Micro-surgical operation: prone positioning, incision from L5 to S3, cyst was fenestrated and fluid removed, cyst wall was removed as closely as possible, and the cavity was covered with gelfoam and fibrin glue  **Comparator (if applicable):** None  **Follow-up time:** 2 months to 13 years | * 82% experienced complete or substantial relief of preoperative symptoms * One participant had a recurrent cyst that was operated on 3 months later with no improvement * No new postoperative neurological defects or infections were observed. * The authors concluded the microsurgical treatment yields the best long-term resolution of symptoms. | Adverse events from intervention:   * One participant had worsening bladder function which resolved within 2 months and one had cerebrospinal fluid leakage |
| Hung24,  2010,  China | **Total number of patients:** 5  **Patient Selection**: individuals who were admitted to institution between 2003 and 2007 were eligible  **Inclusion Criteria:** Symptomatic sacral cysts  **Exclusion Criteria:** None reported.  **Patient Characteristics:** 5 participants (4 females and 1 male) with a mean age of 51.8 years (range 36-66) were included. Cysts were of unknown size and located between S1 and S2.  **Symptoms prior to treatment**: Low back pain (n=3), anal numbness and tingling pain (n=1), bilateral leg numbness (n=1), sacral paresthesia (n=2), and radiculopathy (n=1) | **Study Design:** Case series  **Intervention(s)**: Cyst excision: prone position, laminectomy from S1 to S3, drainage of cyst, and excision of cyst wall.  **Comparator (if applicable):** None  **Follow-up time:** Mean 39.6 months (range 30-51 months) | * All patients remained symptom free | Adverse events from intervention:  None |
| Jiang25,  2015,  China | **Total number of patients:** 42  **Patient Selection**: Individuals with symptomatic sacral perineurial cysts treated at one hospital between June 2009 and August 2012 were eligible for inclusion.  **Inclusion Criteria:** Sacral perineural cyst confirmed by MRI, symptoms, experiencing symptoms for more than 6 months and failing conservative treatments.  **Exclusion Criteria:** History of trauma or infection, anorectal, gynecological, urological or lumbar vertebral diseases.  **Patient Characteristics:** 42 participants (22 females, 20 males) with a mean age of 34.3 years (range 22-56) were included. The participants had symptoms for an average of 20.8 months (range: 7-59 months)  **Symptoms prior to treatment**:Pain in legs (n=5), lumbosacral pain and numbness (n=33), cauda equine compression (n=4), postural changes (n=20) | **Study Design:** Case series  **Intervention(s)**: Surgery: aspiration of cerebrospinal fluid, and injection of fibrin gel  **Comparator:** None  **Follow-up time:** Average of 24 months (range: 13-39 months) | * Twenty-five participants (59.5%) experienced complete resolution of symptoms, eleven experienced partial resolution (defined as minor symptoms that do not interfere with work), and three participants did not experience any improvement in symptoms. * No participants experienced cyst growth within the follow-up period. * 25 cysts disappeared, 14 significantly decreased in size, and 3 had no change in size. | Adverse events from intervention:   * None |
| Lee20,  2004,  Germany | **Total number of patients:** 3  **Patient Selection**: Not reported  **Inclusion Criteria:** Sacral perineural cyst causing sciatic pain and is resistant to pharmacological treatment and physiotherapy  **Exclusion Criteria:** None reported  **Patient Characteristics:** Three participants (all female) ages 24, 35, and 46 were included. The largest cysts were 1.1-3cm in diameter, and all were located between S1 and S2.  **Symptoms prior to treatment**: Increasing lumbo-sacral and left-sided sciatic pain (n=1), lumbosacral pain radiating into the right leg with numbness and urinary urgency (n=1), lumbosacral pain involving the posterior thigh bilaterally (n=1) | **Study Design:** Retrospective case series  **Intervention(s)**: Percutaneous aspiration then surgical intervention  **Comparator (if applicable):** None  **Follow-up time:** 6 months after surgery | * Operative treatment was carried out for Case 1 and 2, and was planned for the third as percutaneous aspiration was not sufficient. * Case 1 and 2 experienced no pain at 6 month follow up * Since patient 3 had not undergone surgery at the time of publication, no results on this patient are presented | Adverse events from intervention:  None |
| Mezzadri32,  2014,  Argentina | **Total number of patients:** 6  **Patient Selection**: Not reported  **Inclusion Criteria:** Diagnosis of Tarlov Cyst by MRI  **Exclusion Criteria:** None reported  **Patient Characteristics:** Six participants (2 females and 32 males) with a mean age of 45 years (range 32-52) were included. Cysts were 4-7 cm in length and 2-3 cm in width, and all were located between S1 and S3.  **Symptoms prior to treatment**:Lumbar pain (n=6), sciatic pain (n=2), perineal pain (n=5), vesical tenesmus (n=1), rectal tenesmus (n=1) | **Study Design:** Case series  **Intervention(s)**: Endoscopic-assisted surgery  **Comparator:** None  **Follow-up time:** Median follow-up of 25.8 months (range 9-52 months) | * All cysts reduced in size; none disappeared completely * The authors concluded that the outcome was excellent in four cases, good in one, and poor in one case * In the case rated as poor, the cyst had refilled with cerebrospinal fluid after 30 days | Adverse events from intervention:   * None |
| Mitra13,  2008,  United States | **Total number of patients:** 2  **Patient Selection**: Not reported  **Inclusion Criteria:** Symptomatic Tarlov cysts treated with steroid therapy  **Exclusion Criteria:** None reported  **Patient Characteristics:** Two participants (1 female and 1 male). Male 61 years old, large cystic lesion the entire circumference of the L5 neural foramen; Female: 38 years old, 5x7mm cystic lesion in the right C6 neural foramen  **Symptoms prior to treatment**: Low back and leg pain (9/10 pain rating), decreased strength, right-sided neck and arm pain (9/10 pain rating). | **Study Design:** Case series  **Intervention(s)**: Intraluminar epidural steroid injection (Male), and oral steroids (Female)  **Comparator (if applicable):** None  **Follow-up time:** 5 month (Male), 3 month (Female) | * Male: No leg pain and less low back pain (2/10), strength returned, complete resolution of the Tarlov cysts * Female: Near complete relief after 6-day course of steroids. At 3-month pain increased to 6/10 | Adverse events from intervention:   * None |
| Mummaneni14,  2000,  United States | **Total number of patients:** 8  **Patient Selection**: Surgically treated at the University of California, San Francisco, between 1992 and 1999.  **Inclusion Criteria:** Symptomatic large sacral Tarlov cysts confirmed by MRI  **Exclusion Criteria:** None reported  **Patient Characteristics:** Eight participants (6 females and 2 males) with age range 34-72 years were included. Cysts were located between S1 and S4.  **Symptoms prior to treatment**: Pain with postural changes (n=3), pain with Valsalva maneuvers (n=2), bladder control (n=3). | **Study Design:** Case series (retrospective)  **Intervention(s)**: Sacral laminectomies  **Comparator (if applicable):** None  **Follow-up time:** Mean follow-up 19 months (range 3-73 months) | * 4/8 patients had complete symptom resolution * 4/8 had improved pain (low dose analgesic needed) * 2/3 regained bladder control | Adverse events from intervention:  None |
| Murphy15,  2011,  United States | **Total number of patients:** 122  **Patient Selection**: Individuals with Tarlov cysts evaluated for treatment between April 2004 and November 2007 were eligible.  **Inclusion Criteria:** None reported  **Exclusion Criteria:** None reported  **Patient Characteristics:** One hundred and twenty-two participants (102 female, 20 male) with a mean age of 54 years (no range given) were included.  **Symptoms prior to treatment**: Bladder and bowel dysfunction (n=9), pain (number not reported) | **Study Design:** Case series  **Intervention(s)**: CT fluoroscopic-guided needle aspiration and fibrin injection using two techniques: single needle (n=69) and two-needle technique (n=50). Surgery was performed on 28 participants. Six participants elected to not have treatment.  **Comparator:** None  **Follow-up time:** Not reported | * *Aspiration and fibrin*: 65% of participants experienced improvement in symptoms, with total improvement in 19%. Symptoms returned for 17 participants, at an average of 7.3 months. * Intraoperative discomfort was reduced using the two-needle technique, and greater volumes of fibrin where injected * *Surgery*: 63% of the participants experienced improvement in symptoms | Adverse events from intervention:   * Mild transient postoperative urticaria in one participant who recovered completely in one day |
| Murphy35,  2015,  United States | **Total number of patients:** 213  **Patient Selection**: Individuals admitted to Johns Hopkins Hospital between 2003 and 2013 were eligible.  **Inclusion Criteria:** Treatment of at least one sacral Tarlov cysts by aspiration  **Exclusion Criteria:** All patients with cystic abnormalities other than perineurial cysts and patients with cysts possessing considerable (wide-neck) direct communication with the subarachnoid space were rejected. Patients who lacked the ability to communicate in English had (1) the probability of inadequate follow-up (eg. those who lived outside North America), (2) any *Diagnostic and Statistical Manual of Mental Disorders* diagnosis (3) unexplained symptoms that were not clearly related to cyst-bearing roots or (as assessed by a neurosurgery nurse practitioner) the presence of ≥2 Waddell signs (to exclude patients whose pain may have considerable nonorganic components) and (4) patients with any other probable identified pain generator besides TCs were also all rejected for treatment. **Patient Characteristics:** 213 participants (unknown genders) with an unknown mean age were included. Mean cyst size unknown, and all were located between L4 to S5.  **Symptoms prior to treatment**: local pain (n=210), L4 L5 neuropathy (n=2), S1 S2 sciatica (n=151), S1 S2 neuropathy (n=137), generalized sacral/lumbar pain (n=189), pelvic/perineal pain (n=209), bladder dysfunction (n=92), sexual dysfunction (n=92), bowel dysfunction (n=62), absent Achilles reflex (n=130), weakness in plantar flexion (n=87), paralysis of plantar flexion (n=2), paralysis of dorsiflexion (n=2), rectal sphincter tone reduction (n=61), bladder sphincter impairment (n=92), cyst related sensory loss (L4 n=1; L5 n=1; S1 n=16; S2 n=137; S3-5 n=97). | **Study Design:** Case series  **Intervention(s)**: CT-guided aspiration, surgery sub-study  **Comparator (if applicable):** None  **Follow-up time:** Follow-up time of at least 6 months with 177 having been followed between 3 and 6 years | * One year post procedure, excellent results were obtained in 104 patients, and good/satisfactory results were obtained in 53 patients. * 157 (81.8%) patients were initially satisfied with the outcome of treatment and at 3-6 months 74.0% of patients followed were satisfied. * Of the 34 patients referred to surgery 31 achieved excellent or satisfactory relief and were satisfied with their outcomes. | Adverse events from intervention:   * One patient had a mild allergic reaction * Three patients appeared to have mild inflammation * Seven patients had symptoms of spinal fluid leak * Twenty-one patients had increased sciatica that resolved. * Seven patients had increased pain but resolved within 3 patients * Three patients had an increase in all symptoms but resolved within 3 months. |
| Neulen21,  2011,  Germany | **Total number of patients:** 13  **Patient Selection**: Individuals diagnosed with Tarlov cysts between June 2008 and October 2010, for whom conservative treatments have failed were eligible  **Inclusion Criteria:** Failure of conservative treatments to alleviate symptoms, diagnosis of Tarlov Cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Thirteen participants (10 females and 3 males) with a mean age of 60 (range not provided) were included. Participants had symptoms for an average of 8.7 years (range 6 months to 30 years). Cysts were located between S1 and S3.  **Symptoms prior to treatment**: Lumbosacral pain (n=10), pain radiating into the buttocks (n=8), legs (n=7), groin/abdomen (n=4), genital region (n=3), and bowel and/or bladder dysfunction (n=3) | **Study Design:** Case series  **Intervention(s)**: Surgery: prone position, cyst was exposed, cerebrospinal fluid was drained, and cyst was removed.  **Comparator:** None  **Follow-up time:** Average 10.7 months (range: 2.5 to 20 months) | * Eight participants significantly improved after surgery, and five participants did not improve * All five participants who did not improve had multiple cysts; additional small or quickly filling cysts were not treated * Best improvement was for pain radiating to legs/buttocks, genital pain, and lumbosacral pain. | Adverse events from intervention:   * One participant developed a cerebrospinal fluid fistula which required a lumbar drain for 7 days |
| Park33,  2008,  Korea | **Total number of patients:** 2  **Patient Selection**: Not reported  **Inclusion Criteria:** Symptomatic sacral Tarlov cyst.  **Exclusion Criteria:** None reported.  **Patient Characteristics:** Two participants (both females) 43 and 47 years old were included. Cysts were 25x15x25mm at S2 and 28x13x27mm at S2.  **Symptoms prior to treatment**: Case 1: right side buttock and perianal pain. Case 2: adenomyosis, perineal pain | **Study Design:** Case series  **Intervention(s)**: Laminectomy  **Comparator (if applicable):** None  **Follow-up time:** Not reported | * In both cases the cyst was removed and cerebrospinal fluid leaking was not seen. The symptoms improved immediately after surgery. | Adverse events from intervention:   * None |
| Patel16,  1997,  United States | **Total number of patients:** 4  **Patient Selection**: Consecutive cases presenting with sacral meningeal cysts were eligible for inclusion (date of recruitment not specified).  **Inclusion Criteria:** Patients with sacral meningeal cysts.  **Exclusion Criteria:** None reported.  **Patient Characteristics:** Four participants (3 females and 1 male) with age range of 40-62 years old. All cysts were located between S1 and S5.  **Symptoms prior to treatment**: Severe lower back pain (n=3), bilateral leg weakness (n=1), pelvic pains with vesical and vaginal discomfort (n=1), urinary incontinence and urgency (n=1), severe perineal pain with difficulty urinating (n=1). | **Study Design:** Case series  **Intervention(s)**: Cyst aspiration and fibrin glue placement  **Comparator (if applicable):** None  **Follow-up time:** 1 year 11 months | * Symptoms recurred in all four patients within 17-28 weeks after cyst aspiration but symptoms improved or resolved after fibrin glue placement * After fibrin glue placement, there was no evidence of recurrence from 7 months to 1 year 11 months. | Adverse events from intervention:  One patient had aseptic meningitis (resolved with medication) |
| Paulsen17,  1994,  United States | **Total number of patients:** 5  **Patient Selection**: Consecutive individuals who had an imaging scan for low back pain were eligible.  **Inclusion Criteria:** Symptomatic perineurial cysts  **Exclusion Criteria:** None reported  **Patient Characteristics:** 5 participants (all female) with a mean age of 52.8 years (range 37-73) were included. Cysts were 1.6-3.0 cm, with unknown location.  **Symptoms prior to treatment**: Local sacral pain (n=2), and ipsilateral radiculopathy (n=3) | **Study Design:** Case series  **Intervention(s)**: Percutaneous drainage  **Comparator (if applicable):** None  **Follow-up time:** Unknown (estimated 3 weeks to 8 months) | * Case 1: received 2-3 weeks of relief each time * Case 2: 4 months of relief each time * Case 3: 6 weeks relief then died from preexisting ovarian cancer * Case 4: relief for 3 weeks * Case 5: relief for 6 months with no reoccurrence | Adverse events from intervention:  None |
| Potts18,  2015,  United States | **Total number of patients:** 35  **Patient Selection**: Individuals admitted to University of California between 2003 and 2011 were eligible.  **Inclusion Criteria:** Symptomatic giant sacral Tarlov cysts  **Exclusion Criteria:** None reported  **Patient Characteristics:** 35 participants (29 females and 6 males) with mean age of 51.9 years (range unknown) were included. Cysts were a mean size of 3.6 cm, and were all located L5 to S5  **Symptoms prior to treatment**: sacroiliac pain (n=18), radiculopathy (n=7), back pain (n=5), perineal pain (n=5), motor deficit (n=4), sensory deficit (n=17), bladder dysfunction (n=16), fecal incontinence (n=7), postural aggravation (n=32), and valsalva aggravation (n=20) | **Study Design:** Retrospective case series  **Intervention(s)**: Microsurgery  **Comparator (if applicable):** None  **Follow-up time:** Median follow-up of 8 months (range 1 month to 7.2 years). Any follow-up achieved in 86% of patients. | * 93% improved pain symptoms * 50% developed recurrent sacral perineal symptoms * Reoccurrence of symptoms were attributed to degenerative lumbar disease or residual sciatic/sacral pain. * All but one patient who had cyst obliteration had improvement in presenting symptoms * The authors report that the technique initially obliterates or reduces cysts and therefore an improvement in pain symptoms, but these symptoms often recurred. | Adverse events from intervention:   * Two patients had incisional erythema * One patient had a superficial seroma * Two patients had headaches * One patient had a pulmonary embolus * Three patients developed pseudomeningoceles |
| Roche10,  1982,  France | **Total number of patients:** 5, 2 of which had Tarlov cysts and are summarized here.  **Patient Selection**: Not reported  **Inclusion Criteria:** Lombo-sacral cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** 2 with Tarlov cysts, one 67-year-old woman with an S2 cyst, one 64-year-old man with multiple Tarlov cysts including a large one in S1  **Symptoms prior to treatment**: Lumbar pain (n=1), sciatic pain (n=1), perineal pain (n=1) | **Study Design:** Case series  **Intervention(s)**: Surgery, including laminectomy (n=1)  **Comparator (if applicable):** None  **Follow-up time:** Not reported | * One patient had temporary pain relief but pre-surgery pain eventually returned * One patient had their pain reduced after surgery | Adverse events from intervention:  None reported |
| Sajko34,  2009,  Croatia | **Total number of patients:** 3  **Patient Selection**: Individuals presenting to the Department of Neurosurgery at the University Hospital in Zagreb, Croatia between January 2000 and November 2007 with symptomatic large sacral perineurial cysts were eligible for inclusion.  **Inclusion Criteria:** Symptomatic large sacral perineurial  **Exclusion Criteria:** None reported  **Patient Characteristics:** Three participants (all female), with a mean age of 58.3 (range: 48-68) were included. The patients had symptoms for 2 weeks, 6 months, and five years.  **Symptoms prior to treatment**: Low back pain (n=3), root radical pain (n=2), sensory disturbances (n=2), weak leg motor strength (n=2), bladder dysfunction (n=1), claudication (n=1) | **Study Design:** Case series  **Intervention(s)**: *Surgery:* fenestration of cyst wall and removal of cerebrospinal fluid, cyst was resected and cyst wall was removed.  **Comparator:** None  **Follow-up time:** Not reported | * All three participants experienced substantial relief from symptoms. One participant had temporary worsening of bladder dysfunction, which resolved within one month. All participants had mild low back pain following surgery. | Adverse events from intervention:   * None |
| Sen3,  2012,  India | **Total number of patients:** 2  **Patient Selection**: Not reported  **Inclusion Criteria:** Diagnosis of Tarlov cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Two participants were included: a 34 year old female who had symptoms for previous 6 months, and a 28 year old male.  **Symptoms prior to treatment**: Low back pain radiating to lower limbs (n=1), weakness in legs and feet (n=1), perianal paraesthesia (n=1), bowel and bladder incontinence (n=1) | **Study Design:** Case series  **Intervention(s)**: Surgery: aspiration and excision of cyst  **Comparator:** None  **Follow-up time:** average 3.5 years (range: 2-5 years) | * Both participants were symptom free during follow-up time * No regrowth occurred at last follow-up. | Adverse events from intervention:   * None |
| Seo5,  2014,  Korea | **Total number of patients:** 3  **Patient Selection**: Not reported  **Inclusion Criteria:** Diagnosis of Tarlov cyst  **Exclusion Criteria:** None reported  **Patient Characteristics:** Three participants (1 female, 2 males) who were 61, 21 and 60 years old were included. Size of cysts was not reported.  **Symptoms prior to treatment**: pain (n=3), hypesthesia (n=2), incontinence (n=1), motor weakness (n=1), claudication (n=1), radiculopathy (n=1) | **Study Design:** Case series  **Intervention(s)**: Surgery: patient was placed prone on the Wilson frame, incision was made from L4 to S4, cyst was dissected.  **Comparator:** None  **Follow-up time:** Mean follow-up of one year | * Patients rated pain on a scale of 1-10 with 10 being the most pain. Prior to surgery, patients rated pain as 7 and 9. One year after surgery, pain was 2 and 3. * In all three cases, there was complete resolution of the cyst, and no regrowth was seen one year post-surgery. Two participants had mild back pain at 1 year. | Adverse events from intervention:   * None |
| Sharma22,  2015,  India | **Total number of patients:** 3  **Patient Selection**: Not reported  **Inclusion Criteria:** None reported  **Exclusion Criteria:** None reported  **Patient Characteristics:** Three participants (2 females and 1 male) 28, 42, or 48 years old were included. Cysts of unknown size located between L4 to S4.  **Symptoms prior to treatment**: Low back pain (n=2), numbness on the medial aspect of the left lower limb, weakness in lower limb, pain in lower limbs. | **Study Design:** Case series  **Intervention(s)**: Laminectomy  **Comparator (if applicable):** None  **Follow-up time:** Not reported | * All the patients were relieved of the radicular pain with no new neurological deficit following surgery. | Adverse events from intervention:  One developed a postoperative cerebrospinal fluid leak. |
| Sun7,  2013,  China | **Total number of patients:** 38  **Patient Selection**: Consecutive participants who were diagnosed with sacral extradural meningeal cysts with spinal nerve root fibers who underwent nerve root sheath reconstruction between June 2009 and October 2012 were eligible for inclusion.  **Inclusion Criteria:** Radiological findings consistent with sacral extradural meningeal cysts, neurological symptoms attributable to a sacral extradural meningeal cyst, and sacral extradural meningeal cysts with spinal nerve root fibers.  **Exclusion Criteria:** Patients symptoms could not be differentiated from lumbar spinal stenosis or lumbar intervertebral disc herniation.  **Patient Characteristics:** Thirty-eight participants (24 females and 14 males) with a mean age of 41.4 (range 13-70 years old) were included. Participants experienced symptoms for 34.2 months on average. The mean number of cysts per patient was 1.8.  **Symptoms prior to treatment**: pain (n=31), sensory dysfunction (n=16), leg weakness (n=11), incontinence (n=10), numbness (n=1), bearing-down feeling (n=1) | **Study Design:** Prospective Cohort Study  **Intervention(s)**: Laminectomy: incision from L5 to S3, laminectomy was performed, and cyst is dissected  **Comparator:** None  **Follow-up time:** Mean follow-up of 21 months | * Out of the 16 participants who had sensory dysfunction, ten did not have sensory dysfunction after surgery and six did. * Ten participants had improved leg strength, one still had leg weakness * After surgery, 17 participants had complete resolution of cyst, six had a small cyst remaining, and fifteen had no cysts but effusion into the canal cavity | Adverse events from intervention:   * None |
| Takemori30,  2014,  Japan | **Total number of patients:** 2  **Patient Selection**: Not reported  **Inclusion Criteria:** None reported  **Exclusion Criteria:** None reported  **Patient Characteristics:** Two participants, a 62 year old female and a 35 year old female were included.  **Symptoms prior to treatment**:Low back pain (n=2), sciatica (n=1), leg weakness (n=1), bladder and/or bowel dysfunction (n=2) | **Study Design:** Case series  **Intervention(s)**: Surgery: removal of laminae to expose cyst, fenestration of cyst wall, insertion of subarachnoid shunt  **Comparator:** None  **Follow-up time:** 7 years and 2 years | * One year after surgery, one participant had no symptoms and continued to have no symptoms until the end of follow-up at 7 years. Participant did not experience any recurrence of symptoms or regrowth of cyst * Six months after surgery, one participant had resolution of symptoms other than numbness in perineal region. Participant was symptom free until the end of follow-up at 2 years, and did not experience any regrowth of cyst | Adverse events from intervention:   * None |
| Tanaka31,  2006  Japan | **Total number of patients:** 12  **Patient Selection**: Surgical admission from 1995 to 2003  **Inclusion Criteria:** Radiological findings consistent with sacral perineural cysts and neurological symptoms attributable to sacral perineural cysts.  **Exclusion Criteria:** None reported  **Patient Characteristics:** 12 participants (5 females and 7 males) with mean age of 50.6 years (range 21-72) were included. Cysts were 1.5-4.2 cm and all were located between S2 and S5.  **Symptoms prior to treatment**: lumbosacral pain (n=8), urinary disturbance (n=8), perianal pain (n=5), leg pain (n=2), sensory disturbance (n=8), and leg weakness (n=1) | **Study Design:** Retrospective case Series  **Intervention(s)**: Laminectomy: incision between L5 and S3, recapping laminectomy or simple laminectomy was performed.  **Comparator (if applicable):** None  **Follow-up time:** Mean follow-up of 31.7 months (range 6-52 months) | * 10/12 improved post-op * 4/8 had pain relief * 5/7 had resolved urinary disturbance * 5/5 perianal pain relief * No leg pain relief | Adverse events from intervention:   * One had prostatitis, and one had cerebellar bleeding |
| Voyadzis,1  2001,  United States | **Total number of patients:** 10  **Patient Selection**: Consecutive individuals presenting with Tarlov Cysts between 1989 and1999 meeting the criteria below were eligible for inclusion.  **Inclusion Criteria:** Radiological findings consistent with Tarlov Cysts, neurological symptoms attributable to Tarlov cysts, intraoperative findings consistent with Tarlov cysts.  **Exclusion Criteria:** None reported  **Patient Characteristics:** Ten participants (2 males, 8 females) with a mean age of 48.1 (range: 34-63) were included.  **Symptoms prior to treatment**: Not reported | **Study Design:** Case study  **Intervention(s)**: Incision from L5-S3, laminectomy, dissection of Tarlov cyst, Gelfoam and fibrin glue were used  **Comparator (if applicable):** None  **Follow-up time:** Mean follow-up of 31.7 months | * 70% experienced complete or substantial resolution of symptoms * 30% did not experience significant improvement. | Adverse events from intervention:   * Numbness, overflow urinary incontinence |
| Zhang26,  2007,  China | **Total number of patients:** 31  **Patient Selection**: Not reported  **Inclusion Criteria:** None reported  **Exclusion Criteria:** None reported  **Patient Characteristics:** 31 participants (19 females, and 12 males) with a mean age of 38.5 (range: 20-66) were included.  **Symptoms prior to treatment**: Bowel dysfunction (n=2), pain in perineural region (n=15), muscle atrophy (n=3), urinary dysfunction (n=9), tenderness in lumbosacral region (n=26), radicular pain in leg with percussion of perineal region (n=21), sensory disturbance and weakened muscle in legs (n=15), sensory disturbance in perineal region (n=16) | **Study Design:** Case series  **Intervention(s)**: Computed tomography guided percutaneous injection of fibrin glue after aspiration  **Comparator (if applicable):** Computed tomography guided percutaneous injection of fibrin glue without aspiration  **Follow-up time:** Mean follow-up of 23 months (range: 10-28 months) | * *Aspiration:* 4/15 experienced complete relief, 8/15 experienced significant relief with some enduring lumbosacral pain, 2/15 had no improvement or worsening, 1/15 experienced worsening of symptoms * *No aspiration:* 5/16 experienced complete relief, 7/16 experienced significant relief with some enduring lumbosacral pain, 3/16 had no improvement or worsening, 1/16 experienced worsening of symptoms | Adverse events from intervention:   * Headache, dizziness, fever, vomiting |
| Xu27,  2012,  China | **Total number of patients:** 15  **Patient Selection**: Participants with symptomatic sacral perineural cysts who were treated at the General Hospital of Fengfeng Group from 1998 to 2010, and whose follow-up was more than one year were eligible for inclusion.  **Inclusion Criteria:** Diagnosis of symptomatic sacral perineural cysts by MRI, follow-up longer than one year. Surgery, if 1) diameter was more than 1.5 cm, 2) neurological symptoms were attributable to cyst 3) little response to medical or physical therapy.  **Exclusion Criteria:** None reported  **Patient Characteristics:** Fifteen participants (6 females, 9 males) with a mean age of 37.8 years (range: 23-60 years) were included.  **Symptoms prior to treatment**: Low back pain or sacrococcygodynia (n=12), sacral radiculopathy (n=7), numbness (n=6), sensory disturbance of the sacral dermatome (n=9), claudication (n=4), bowel and bladder dysfunction (n=6). | **Study Design:** Case series  **Intervention(s)**: Six patients had sacral laminectomies, microsurgical cyst fenestration and cyst wall imbrication. Seven had a modified procedure where after sacral laminectomies, cysts were fenestrated with scalpel, contents were drained and the cyst wall was partially removed.  **Comparator:** CT guided aspiration  **Follow-up time:** Average 40.6 months (range: 13-124) | * *Microsurgical cyst fenestration and imbrication*: all six participants experienced complete or substantial resolution of symptoms. Eight months after surgery, one patient had a recurrent cyst. * *Modified surgery:* six of the seven experienced complete or substantial resolution of symptoms. One patient had worsened bladder dysfunction, which recovered to normal after one month. * *No surgery:* Two patients were treated with physical therapy and medication. Both experienced worsening of symptoms, and continuing growth of cyst. | Adverse events from intervention:   * One participant had a cerebrospinal fluid leak, which was resolved within a week |
| Ziegler11,  1982,  France | **Total number of patients:** 5, 3 of which had Tarlov cysts and are summarized here  **Patient Selection**: Not reported  **Inclusion Criteria:** Sacral meningeal cyst that was operated on  **Exclusion Criteria:** None reported  **Patient Characteristics:** 3 with Tarlov cysts, one cyst each; two women, one man; ages 32, 64, 67; cysts 2-7cm long, 1-3cm in diameter; S1 and S2  **Symptoms prior to treatment**: lumbar pain (n=3), leg pain (n=2), perineal pain (n=1) | **Study Design:** Case series  **Intervention(s)**: Surgery, removal of cyst  **Comparator (if applicable):** None  **Follow-up time:** At least one year (n=2), at least one month (n=1) | * Symptoms eliminated in 1 patient * Symptoms temporarily eliminated in 2 patients but they returned in 1 month and 1 year | Adverse events from intervention:   * None |

Table 2: Quality Assessment of Clinical Studies

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| Downs and Black39 Question Number | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Author | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Q11 | Q12 | Q13 | Q14 | Q15 | Q16 | Q17 | Q18 | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 | Q25 | Q26 | Q27 | Total |
| Ahmed28 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Asamoto29 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 11 |
| Beraud12 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 8 |
| Cantore6 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Caspar19 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Guo23 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 15 |
| Hung24 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Jiang25 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Lee20 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Mezzadri32 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Mitra13 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Mummaneni14 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Murphy15 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Murphy15 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 14 |
| Neulen21 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Park33 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 14 |
| Patel16 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Paulsen17 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Potts18 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 14 |
| Roche10 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 8 |
| Sajko34 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Sen3 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Seo5 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Sharma22 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 11 |
| Sun7 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Takemori30 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 12 |
| Tanaka31 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 16 |
| Voyadzis1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 14 |
| Xu27 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Zhang26 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 13 |
| Ziegler11 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | N/A | 0 | 0 | 0 | 1 | 0 | 7 |