

# Cervical Spinal Tuberculosis: A Preliminary Study of Clinical Diagnosis and Management

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**Background:** Cervical involvement in spinal tuberculosis is rare; however, delayed diagnosis and treatment may result in massive, irreversible neurological deterioration. The purpose of this study is to report on a strategy for clinical diagnosis and management of cervical spinal tuberculosis.

**Material and Method:** Eighteen patients (13 males and 5 females) during 1998-2013 were retrospectively reviewed at Chiang Mai University Hospital. The patients had a mean age of 51.4 years (range 37-68 years). History, examination, radiographs, MRI and tissue sampling were used in diagnosis. Most of the patients were given antituberculous therapy (ATT) and underwent surgical management. The mean follow-up period was 12.8 months.

**Results:** Axial neck pain, quadriparesis, spastic gait and hand clumsiness were the predominant symptoms. Disc narrowing, end plate destruction and paraspinous soft tissue swelling were the prominent radiographic findings. MRI found Gadolinium enhancement of prevertebral soft tissue, T2 hypersignal of the intervertebral discs, intraosseous T2 hypersignal at the vertebral body, and disc fragmentation. Thirteen patients underwent single-stage anterior debridement with fusion. Three patients underwent posterior fusion alone. Axial neck pain improved in all patients. Nurick's disability index and fusion rate improved in 70% of the patients after conservative and surgical treatment.

**Conclusion:** Cervical spinal tuberculosis should be suspected in endemic patients with severe neck pain and progressive neurological deficit. Histopathology is the gold standard of tuberculosis diagnosis. Anti-tuberculosis drugs should be continued for at least 12 months. Radical anterior debridement and instrumented fusion has demonstrated favorable results. The posterior approach is an alternative treatment in patients when the anterior approach cannot be performed or as part of second-stage surgery.

**Keywords:** Cervical spinal tuberculosis, Clinical diagnosis, Imaging, Management

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Cervical involvement in spinal tuberculosis is uncommon. The major consequences can include spinal instability and neurological deterioration<sup>(1)</sup>. Cervical spinal tuberculosis remains a diagnostic dilemma as both clinical diagnosis and management are still controversial. Treatment options have varied from fully conservative to radical surgery<sup>(2,3)</sup>. The purpose of this study is to report on the strategy used for clinical diagnosis and management of cervical spinal tuberculosis in 18 patients.

## Material and Method

Eighteen patients with cervical spinal tuberculosis who were treated at Chiang Mai University Hospital between 1998 and 2013 were included in the present study. These patients had been followed-up for at least six months.

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Their clinical presentations, radiographic studies, intraoperative findings, histopathology of tissue samples and clinical follow-up data were reviewed retrospectively. Pre- and post-operative neurological grade was measured using Nurick's disability index (grade 0 = root signs and symptoms, no cord involvement; grade I = signs of cord involvement, normal gait; grade II = mild gait involvement, able to be employed; grade III = gait abnormality prevents employment; grade IV = able to ambulate only with assistance; grade V = chair-bound or bedridden).

Antituberculous therapies (ATT) were started in all patients who had been given an initial diagnosis of tuberculosis based on clinical presentation, radiological images and tissue diagnosis. The ATT regimen included Isoniazid (5 mg/kg/day), Rifampicin (10 mg/kg/day), Ethambutol (15 mg/kg/day) in a single daily dose, and Pyrazinamide (25 mg/kg/day in three divided doses) for two months. Isoniazid and Rifampicin were administered continuously for ten months. Indications for operative management

included uncertain clinical diagnosis, large epidural abscess causing progressive neurological deficit, spinal instability and severe pain. All but two patients who had severe medical problems underwent surgical treatment.

## Results

### Location of cervical spine involvement

Three patients with upper cervical spine (Occiput-C2) involvement reported an average duration of symptoms of 2.8 months. One patient presented with torticollis. Lower cervical spine (C3-C7) involvement was common (n = 15; 83%). Average duration of symptoms was 5.5 months.

### Clinical presentation

Predominant symptoms included severe axial neck pain (n = 18; 100%), progressive quadriparesis (n = 12; 66%), spastic gait (n = 7; 41%) and hand clumsiness (n = 8; 44%). Patients' preoperative disability level was graded using Nurick's disability index as follows: Grade 0 (n = 1), Grade II (n = 1), Grade III (n = 3), Grade IV (n = 9), Grade V (n = 4). Bladder involvement was present in 7 patients (38%), pulmonary TB in 4 patients (22%), torticollis in 1 patient (5%) and severe respiratory compromise in 2 patients (11%). One of these patients was given second-line chemotherapy because of an allergy to first-line drugs.

### Plain radiographs

The most frequent radiographic findings were disc space narrowing (n = 15; 83%) vertebral end plate destruction (n = 13; 72%), and paraspinal soft tissue swelling (n = 12; 66%). Other problems identified from radiographs were vertebral body collapse with kyphosis (n = 10; 55%) and basilar invagination (n = 1; 5%).

### Magnetic resonance imaging (MRI)

MRI findings included gadolinium enhancement of prevertebral soft tissue (n = 13; 72%),

intraosseous T2 hypersignal in vertebral bodies (n = 12; 66%), T2 hypersignal at intervertebral discs (n = 8; 44%), and intervertebral disc fragmentation (n = 5; 27%). Thecal sac compression was seen in all patients.

### Management (Table 1)

In addition to the anti-tuberculosis therapy (ATT), surgery was performed in 16 patients (88%). Of the three patients with upper cervical tuberculosis, two (11%) had a satisfactory response to ATT within three months. They were kept on conservative management with external immobilization for 12 months. The third patient with upper cervical tuberculosis underwent indirect posterior decompression and stabilization (Fig. 1). Thirteen patients (72%) underwent a single-stage anterior debridement and corpectomy with fusion (Fig. 2), while three patients (17%) underwent posterior fusion alone.

### Proof of tuberculosis

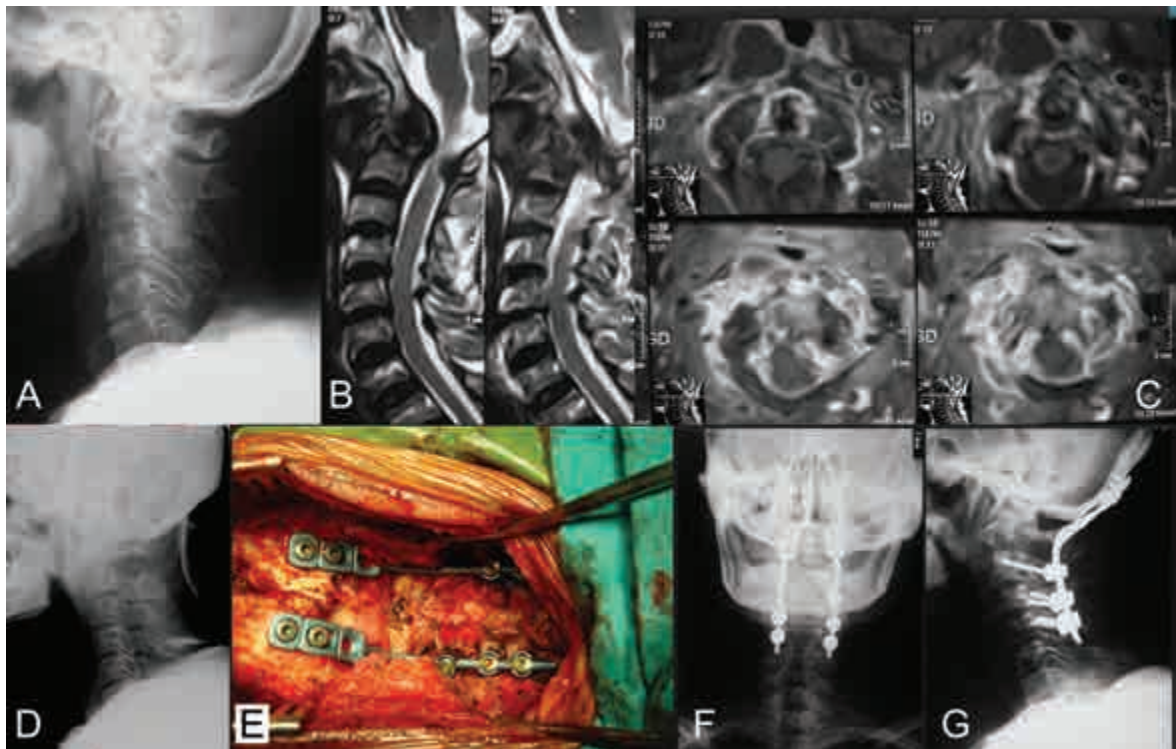
Histopathologic tissue findings in 16 cases were suggestive of chronic caseating granulomatous inflammation with giant cells compatible with tuberculosis (Fig. 3). Acid-fast bacilli, however, were identified in only five cases. None of all patients was found TB culture positive.

### Clinical outcome

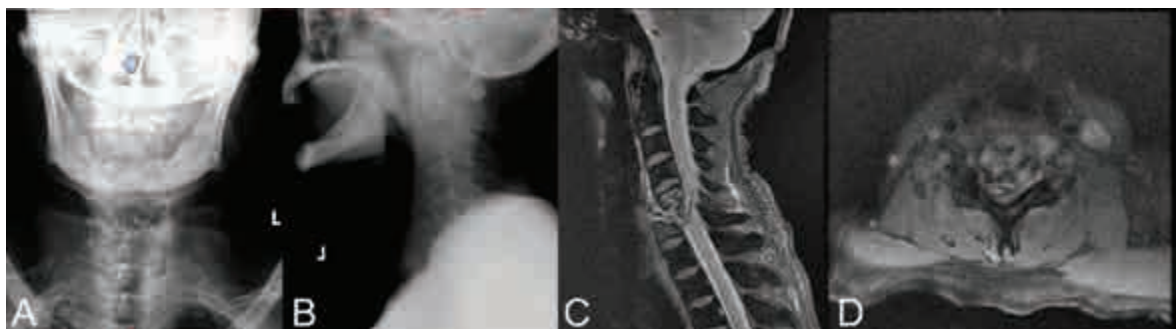
Of the 18 patients who presented with axial neck pain, 14 (77%) that had received operative treatment were pain-free at the final follow-up examination. One patient that had received conservative treatment (anti-tuberculosis drug and a rigid cervical orthosis) complained of persistent pain requiring prolonged use of analgesic drugs. Two patients died from unrelated severe medical problems. There was a significant difference in pain reduction outcomes between operative and conservative treatments. Improvement in paraplegia, Nurick's disability index and fusion rate were observed in more than 70% of the patients who had undergone anterior and

**Table 1.** Results of management options

	Conservative	Anterior surgery	Posterior surgery
Neck pain improvement	+	+++	++
Neurological improvement	+	+++	++
Postoperative kyphosis	+++ (gibbus)	+	+
Fusion rate (months)	12-15	3-6	9-12
Nurick's disability index	Not improved	Improved I-II grades	Improve fairly



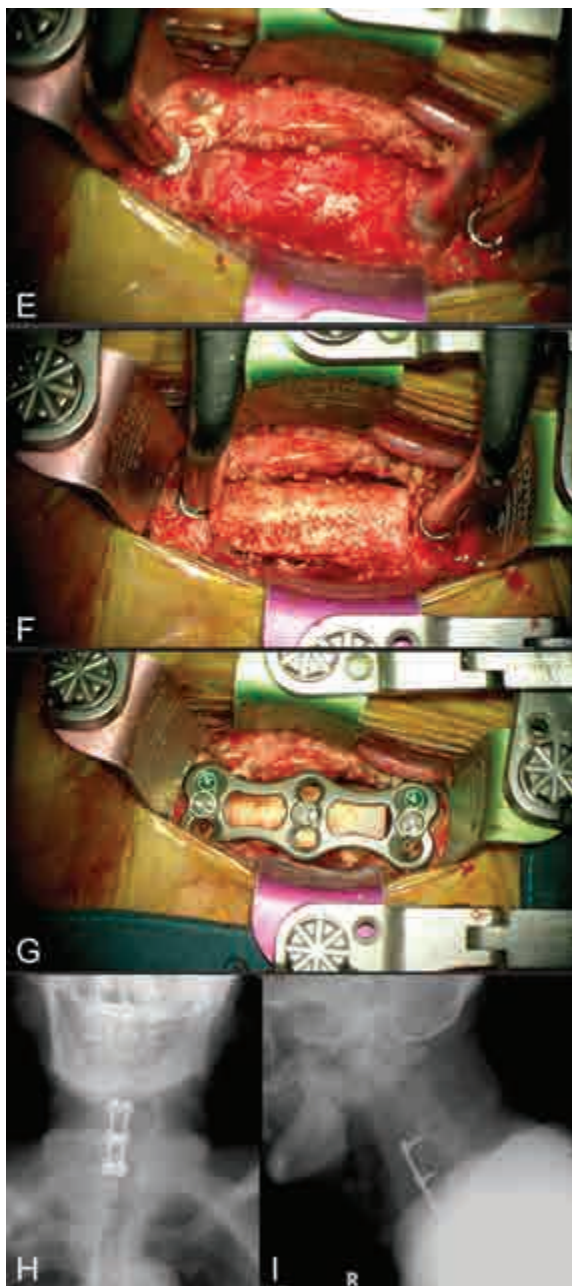
**Fig. 1** (A) Lateral cervical spine X-ray of a 69-year-old female with occipito-cervical neck pain, spastic gait and progressive weakness showed destruction of C2 vertebral body. (B) T2-weighted sagittal MRI showed intraosseous hypersignal with C2 vertebral body destruction and mild degree of basilar invagination with spinal cord compression. (C) Axial T2 image showed prevertebral and intraosseous T2 hypersignal with C2 vertebral body destruction resulting in spinal cord compression. (D) Preoperative cervical traction. (E) Posterior fossa decompression and posterior instrumentation and fusion occiput to C4. (F, G) Plain radiograph after posterior instrumentation and fusion.



**Fig. 2A-D** (A) AP X-ray of the cervical spine of a 56-year-old male with axial neck pain and progressive weakness for two months. (B) Lateral X-ray showed prevertebral soft tissue swelling of the lower cervical spine with C5-6 disc space narrowing. (C) T2-weighted sagittal MRI of the cervical spine showed C5-C6 vertebral body destruction and collapse with prevertebral and epidural abscess. C5-6 disc fragmentation with retropulsion into the spinal canal caused severe spinal cord compression. (D) T2-weighted axial MRI showed intraosseous hypersignal at vertebral body C5 with vertebral body destruction.

instrumented surgeries, posterior surgeries or conservative management. Of the seven patients who presented with bladder involvement and who received

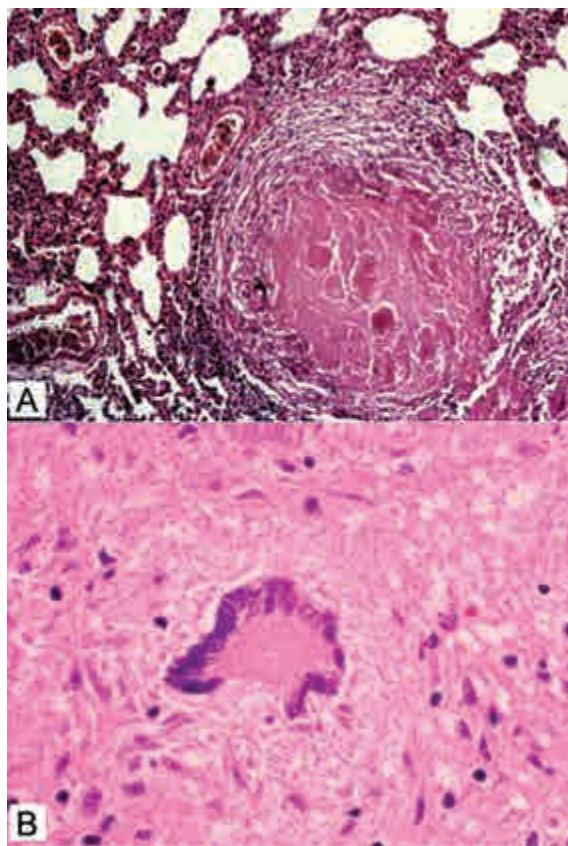
operative treatment, five improved but had residual symptoms such as urinary incontinence. One patient became dependent on an indwelling catheter.



**Fig. 2E-I** (E, F, G) Radical anterior debridement, corpectomy and fusion with cervical plating. (H, I) Plain radiographs after anterior cervical corpectomy C5-C6 and fusion with anterior plating C4-C7.

### Discussion

Cervical spinal tuberculosis is challenging both in terms of clinical diagnosis and in management. Clinical presentations in early cases are nonspecific. In patients with upper cervical spine tuberculosis, pain in the occipital area usually occurs<sup>(4,5)</sup>. Other



**Fig. 3** Histopathology finding of cervical spinal tuberculosis demonstrated caseous granulomatous inflammation (A) with Langhans' giant cell (B).

reported presentations include torticollis, twelfth nerve palsy, hoarseness, difficulty swallowing, stridor and nystagmus<sup>(6)</sup>. Lower cervical involvement usually presents with neck pain, stiffness, torticollis, restriction of neck movement, progressive limb weakness and loss of bladder control<sup>(2)</sup>. In the present study axial neck pain was the predominant symptom, found in all cases; cervical myelopathy and progressive weakness were detected in 44% and 66% of cases, respectively.

Several radiologic abnormalities have been described for suspected cervical spine tuberculosis such as increased width of the retropharyngeal soft-tissue space seen in lateral X-rays, increased atlantodental interval, osteolytic erosion and endplate destruction<sup>(1,6-8)</sup>. The most significant radiological hallmark, "prevertebral soft tissue swelling, destruction of vertebral end plate & vertebral body and disc space narrowing", should arouse suspicion of cervical spinal tuberculosis. Paravertebral calcification is rarely seen in cervical spinal tuberculosis, unlike thoracolumbar involvement.

MR imaging allows early detection of subtle changes, e.g., signal changes in the vertebral bodies and peridiscal signal changes<sup>(8)</sup>. Findings in more advanced cases include vertebral body destruction with abscess formation, epidural abscess, and kyphotic deformity causing spinal cord compression<sup>(9)</sup>. Gadolinium-enhanced MRI is important for diagnosis by demonstrating paravertebral and prevertebral lesions. T2 intraosseous hypersignal at the vertebral body, fragmentation of the intervertebral disc, and subligamentous extension of the neighboring vertebrae were also found.

In patients who did not undergo surgery but had suspected hallmark clinical and radiological findings were treated with antituberculous drugs for at least 12 months. Traction alone in some cases was found to be sufficient to reduce early subluxation and minor grading of cervical myelopathy. Most studies agree that a combination of treatments (medical, orthosis, surgical) is highly effective in patients with cervical spinal tuberculosis<sup>(4,5,7-10)</sup>. If the disease is proved histologically compatible with tuberculosis, a first-line ATT regimen should be started (2 IREZ + 10 IR).

Depending on the degree of pain, deformity, neurological deficits and response to ATT treatment, surgical treatment is indicated for progressive neurological deficit, spinal instability, large epidural abscess and severe intractable pain. Radical anterior debridement and fusion is preferred for large prevertebral abscess and severe myelopathy. Posterior stabilization is an alternative option for augmentation of fusion when extensive bony removal is needed and to avoid complications from anterior surgery.

### **Conclusion**

Tuberculosis of the cervical spine is rare. Clinical and radiological findings should be considered in endemic patients who presented with severe axial neck pain with progressive neurological deficit and whose radiological findings show hallmarks of the disease. Administration of anti-tuberculosis drugs is the key medical management and should be continued for at least 12 months in all cases. Radical debridement and instrumented fusion surgeries should be offered when indicated in cases of large prevertebral and epidural abscess, progressive neurological deficit and spinal instability. Anterior surgery is preferred for large anterior epidural abscess and severe cases of myelopathy. Posterior approach is the alternative treatment option in some cases that cannot undergo the

anterior approach or as a part of second-stage fixation and fusion. Anterior debridement (transoral approach) and external stabilization and immobilization is an alternative option for craniovertebral junction and upper cervical tuberculosis.

### **What is already known on this topic?**

Cervical spine involvement of tuberculosis is less commonly found when compared to the thoracic and lumbar spine. History, physical examination and radiologic findings are used to perform initial diagnosis. MRI is the gold standard for spinal imaging, however, tissue diagnosis is the most important. In cervical spine tuberculosis, medical treatment is still the mainstay. Furthermore, radical surgical debridement is strongly suggested, if indicated.

### **What this study adds?**

Patient history and examination are nonspecific for giving diagnosis of cervical spine tuberculosis. Radiologic hallmark is disc narrowing, endplate destruction, vertebral collapse and paravertebral calcification. MRI is the imaging of choice, but still unable to differentiate with the other microorganisms causing spinal infection. Subligamentous spreading seen in MRI may suggest tuberculosis. Tissue diagnosis is mandatory. Antituberculous medications must be continued not less than 12 months. Medical treatment combined with external orthosis is used in mild cases. Anterior element of the cervical spine is usually involved by tuberculosis; thus, anterior radical surgery is the preferred approach. Concomitant anterior instrumented fusion can be done without serious complications. Posterior approach is indirect neural decompression. Fixation may be required to reduce postoperative kyphosis.

### **Acknowledgment**

The authors wish to acknowledge our research assistances for correcting the manuscript format. Sirichai Luevitoonvechkij MD, for his helpful suggestions and to G Lamar Robert PhD, for reviewing the manuscript.

### **Potential conflicts of interest**

None.

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## แนวทางการวินิจฉัยและการรักษาวัณโรคของกระดูกสันหลังส่วนคอ

ต่อพงษ์ บุญมาประเสริฐ, กิตติพงษ์ ดงแสง

**ภูมิหลัง:** กระดูกสันหลังส่วนคอติดเชื้อวัณโรคพบได้ไม่บ่อย การวินิจฉัยและรักษาที่ล่าช้าอาจทำให้เกิดการสูญเสียของระบบประสาท การศึกษานี้กระทำเพื่อแสดงแนวทางการวินิจฉัยและการรักษา

**วัตถุประสงค์และวิธีการ:** ทบทวนข้อมูลจากแฟ้มประวัติผู้ป่วย 18 ราย เพศชาย 13 ราย เพศหญิง 5 ราย อายุเฉลี่ย 51.4 ปี ตั้งแต่ พ.ศ. 2541 ถึง พ.ศ. 2556 ณ คณะแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ บันทึกการตรวจและข้อมูลรังสีวินิจฉัย ผลส่งตรวจผ่าตัดเก็บตัวอย่างส่วนใหญ่ได้รับยาต้านวัณโรคร่วมกับการผ่าตัด ติดตามการรักษาเฉลี่ย 12.8 เดือน

**ผลการศึกษา:** อาการที่พบคือ ปวดต้นคอ แขนและขาเป็นอัมพาต เดินเกร็ง ประสิทธิภาพการใช้มือลดลง ภาพถ่ายเอกซเรย์ที่พบคือ ช่องหมอนรองกระดูกแคบลง การกร่อนของขอบกระดูกสันหลัง การบวมของเงาเนื้อเยื่ออ่อนด้านหน้าแนวกระดูกสันหลัง ผลการตรวจด้วยเครื่องแม่เหล็กไฟฟ้า คือ gadolinium enhancement of prevertebral soft tissue, T2 hypersignal at intervertebral disc, intraosseous T2 hypersignal at vertebral body และ disc fragmentation ผู้ป่วย 13 ราย รักษาโดยการผ่าตัดทางด้านหน้า 3 ราย โดยการผ่าตัดทางด้านหลัง อาการปวดคอดีขึ้นทุกราย ดัชนีคุณภาพและการติดเชื้อกระดูกได้ผลดีขึ้นร้อยละ 70

**สรุป:** ควรตระหนักถึงโรคนี้นั้นผู้ป่วยที่มีอาการปวดต้นคอและพบความผิดปกติของระบบประสาทในพื้นที่ที่โรคซุกซุม ผลตรวจทางพยาธิวิทยาแสดงการวินิจฉัย การให้ยาต้านเชื้อวัณโรคต่อเนื่องอย่างน้อย 12 เดือน ยังเป็นวิธีการรักษาหลัก การผ่าตัดทางด้านหน้าให้ผลการรักษาที่ดี การผ่าตัดทางด้านหลังใช้ในรายที่ผ่าตัดทางด้านหน้าไม่ได้หรือใช้ร่วมกัน

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