

Parvimonas micra as a rare cause of spondylodiscitis – case series from a single centre

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Summary

BACKGROUND: The anaerobe *Parvimonas micra* is usually recovered as part of the normal flora or in polymicrobial infections of odontogenic or gastrointestinal origin. *P. micra* has rarely been described as the causative organism of pyogenic spondylodiscitis. Here we report multiple cases of spondylodiscitis caused by this organism and compare their clinical features with the published literature.

METHODS: We performed a retrospective review of all institutional cases with *P. micra* spondylodiscitis between 01 June 2012 and 31 May 2019. For comparison, the literature was searched for studies reporting vertebral infections with *P. micra* in adult patients.

RESULTS: Over 7 years, six cases were identified: one with a polymicrobial infection (with *P. micra* and *Fusobacterium nucleatum*) and five with *P. micra* as the only pathogen isolated. The six patients with *P. micra* infections were between 63 and 82 years old (median 72 years) and presented with persistent lower back pain. Common findings were infection of the lumbar spine region (in 6/6 cases) and recent dental inflammation (4/6 cases). 3/6 patients had previously undergone decompressive spinal surgery due to spinal stenosis (2 to 11 years before). In 4/6 cases the organism was detected in blood cultures drawn at admission. Treatment consisted of antibiotics for all patients and additional decompressive surgery due to abscess formation in half the cases. Outcomes were mostly favourable, but persistent pain was a common complaint after resolution of infection.

CONCLUSIONS: *P. micra* is a rare cause of spondylodiscitis. Nevertheless, recent dental procedures with subsequent back pain should lead to the consideration of possible anaerobic causes of spondylodiscitis. Heightened awareness of this pathogen and improvements in diagnostic methods might lead to higher detection rates.

Keywords: spondylodiscitis, vertebral infection, *Parvimonas micra*, anaerobic bacteria, case series

Introduction

Spondylodiscitis is an infection of primarily the intervertebral discs, often with the subsequent involvement of adjacent paravertebral structures or vertebral bodies. Mainly older populations are at risk, with the lumbar spine most commonly affected. Other risk factors identified are diabetes mellitus, intravenous drug use and prior spinal surgery [1]. Magnetic resonance imaging (MRI) of the spine is the gold standard for the evaluation of patients with signs or symptoms suggestive of spondylodiscitis. Computed tomography (CT)-guided biopsies or – if this is inconclusive – open biopsies are the gold standard for diagnosis. The Infectious Diseases Society of America (IDSA) guidelines consider positive blood culture with *Staphylococcus aureus* as sufficient evidence of source of infection if spondylodiscitis is diagnosed by MRI [2]. However, the correct diagnosis may be delayed, or even missed, due to unavailability of an MRI diagnosis or pre-analytical errors. Patients often present with the unspecific symptoms of aggravated lower back pain with mild inflammation, leading to delayed diagnosis. If the presentation is more acute, an empiric antibiotic therapy is often necessary before the focus of the infection and its causing pathogen are established, further hindering accurate microbiological diagnosis.

The majority of spinal infections are caused by the haematogenous spread of bacteria from distant infect foci, predominantly due to *S. aureus*, Enterobacteriaceae and, to a lesser extent, Streptococci. Identification of the causing microorganism is crucial for treatment, but can be difficult due to the low sensitivity of blood cultures and negative spinal biopsies. In general, the recovery of anaerobic bacteria from spinal biopsies is very rare, and the most commonly recovered species are *Cutibacterium acnes* and *Bacteroides fragilis* [3].

Parvimonas micra is a gram-positive anaerobe coccus, usually of low clinical significance. They are most prominently part of the normal oropharyngeal flora, but can also be a commensal of the gastrointestinal or urogenital tracts. Infections with *P. micra* mostly occur in the context of polymicrobial infections resulting from these sites. The

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most frequent infections associated with *P. micra* are endodontic infections, oropharyngeal abscesses and, to a lesser extent, pleural empyema and intraabdominal abscesses [4], suggesting a continuous spread as the main infection route. Haematogenous spread to distant locations leading to metastatic infections occurs infrequently. Haematogenous spread is most commonly described in cases of bacteraemia, endocarditis, and invasive infections of the spine, joints, or involving solid organs [5] [6].

Pyogenic spondylodiscitis with *P. micra* as the causative organism has rarely been reported [5]. The present study describes five cases of *P. micra* spondylodiscitis and one case of a mixed infection involving *P. micra* diagnosed in our hospital between 01 June 2012 and 31 May 2019.

Methods

The University Hospital Basel is a tertiary care centre in Switzerland which treats >38,000 adult patients annually. Its different subspecialties include a unit for spinal surgery.

Following the diagnosis of spondylodiscitis with *P. micra* in a female patient and an extensive search to identify the primary focus due to concurrent gastrointestinal, vaginal and dental complaints, we performed a review of our institution's cases of vertebral infections with isolation of *P. micra* for comparison. Additionally, the Pubmed database was searched and all clinical reports of spinal infections with *P. micra* published in English and German were reviewed.

Information from our institution's clinical records and microbiological data were available for the period 01 June 2012 to 31 May 2019. All data were collected as part of routine treatment and diagnostic procedures and were reviewed retrospectively. 278 individual patients were diagnosed with spondylodiscitis. 439 isolates of *P. micra* were cultured from diverse clinical samples. From these 439 samples, we identified six patients with spinal infections: five cases with *P. micra* as the only pathogen involved, and one case with a mixed infection with *P. micra* and *Fusobacterium nucleatum*. Informed consent was obtained from five patients, and in one patient we obtained consent from the common law spouse. The volumetric analysis was performed using the certified software iPlan (Version 3.0), from BrainLab (Heimstetten, Germany).

Case reports

Case 1

An 82-year-old man presented with acute immobilising pain of the lower back and in both shoulder joints. He had a history of chronic lower back pain and had undergone decompressive spinal surgery due to spinal stenosis in L1-L5 over a decade ago. The laboratory results showed elevated inflammatory markers (leucocytes 9.8 G/l and C-reactive protein [CRP] 316.8 mg/l) and renal failure, with a creatinine of 235 µmol/l. Sepsis was suspected, and an empiric antibiotic therapy with amoxicillin/clavulanic acid was started after sampling. A CT scan and MRI revealed a spondylodiscitis in L1-3 with abscess formation in the psoas muscle (3.4 × 3.2 cm) and multiple epidural abscesses from T12 to L5 (the largest, at L1, was 3.2 × 0.5 × 1 cm with a volume of 1.2 cm³), resulting in spinal stenosis. Ad-

ditional findings were a large abdominal aneurysm of the aorta (12 × 18 cm) and splenomegaly.

Because of acute paraplegia resulting from the abscesses, emergency decompression T12-L5 with laminectomy of L2-4 was performed. Blood cultures and intraoperative biopsies grew *P. micra* (Time to positivity [TTP] for blood cultures was 1 d 16 h 30 min). A CT scan showed several tooth root granulomas as a potential primary focus of infection.

The patient developed progressive pancytopenia and persistent renal and cognitive impairment despite intensive care treatment and escalation of antibiotic treatment. The patient died due to an acute rupture of the aneurysm of the abdominal aorta five weeks after presentation.

Case 2

A 69-year-old man presented with lower back pain for three weeks and new hyposensitivity of the left thigh. He had undergone a decompression and discectomy in L2/3 two years ago. Inflammation markers were slightly elevated (CRP 40 mg/l with leucocyte counts within the reference range). The MRI showed spondylodiscitis of the L2/3 disc without intraspinal abscess formation and degenerative changes in the segment. A CT-guided biopsy of the L2/3 disc grew *P. micra*. Following 14 days of intravenous antibiotic therapy with amoxicillin/clavulanic acid, the therapy was switched to oral amoxicillin for an additional 4 weeks.

The patient reported a single episode of fever following a tooth extraction 10 days before the back pain began. A dental focus was suspected, but a CT scan of the jaw showed no residual signs of infection.

A follow-up MRI after 6 weeks of antibiotic therapy showed no abscesses or any other infectious complications. The patient complained about persistent lumbar pain, which decreased over the following months.

Case 3

A 72-year-old male with Parkinson's disease presented with back pain for 2 weeks. The MRI showed spondylodiscitis of the lumbar spine involving segments L1/2 with a multilocular, septate abscess of the right psoas muscle. The total volume of the abscess was 11.6 cm³ (4 × 4.4 × 1.6 cm). A CT-guided biopsy was performed and empiric antibiotic therapy with amoxicillin/clavulanic acid started. The following day the patient became septic, and therefore an open discectomy was performed with drainage of the abscess. *P. micra* was isolated from blood cultures (TTP 2 d 13 h 48 min), the initial biopsy and the abscess. The antibiotic therapy was switched to penicillin intravenously for 2 weeks, and later to amoxicillin orally for an additional 4 weeks.

The patient had undergone a dental procedure 4 weeks before, which might have been the initial portal of entry.

Case 4

A 72-year-old female was referred to our hospital for evaluation of persistent lower back pain for six weeks. She had a history of metastatic breast cancer with vertebral metastases. The MRI showed a destructive spondylodiscitis with an intraspinal abscess at the T12/L1 level and consecutive spinal stenosis. The intraspinal abscess had a total volume

of 5.1 cm³ (2.5 × 0.6 × 1.7 cm). We performed fenestration and evacuation of the abscess. *P. micra* was cultivated from the intraoperative samples as well as from blood cultures (TTP 1 d 20 h 24 min). *F. nucleatum* was also cultivated from the intraoperative samples, but not from blood cultures. Intravenous antibiotic treatment was prolonged due to concomitant pleural effusion and suspected empyema. After 5 weeks of intravenous treatment with amoxicillin / clavulanic acid, therapy was switched to oral moxifloxacin for an additional 6 weeks. No primary focus of infection could be identified in this patient.

A follow-up MRI after 4 weeks of antibiotic therapy showed no signs of residual abscesses. The patient cancelled the scheduled follow-up appointments.

Case 5

A 72-year-old male presented with a history of lumbago for 3 months. He had been operated for spinal stenosis in L2–5 6 years previously. The initial MRI showed degenerative changes in L4/5 (Modic 1) without clear signs of infection. Due to persistent pain, a second MRI was performed 4 weeks later, showing progressive degenerative changes without evidence of abscesses. Two CT-guided biopsies were performed; neither was diagnostic. One blood culture grew *P. micra* (TTP unknown), which was initially classified as a contaminant. To confirm the diagnosis, a transpedicular biopsy of L5 and the L4/5 disc was performed. Antibiotic therapy consisted of penicillin and ertapenem intravenously for 2 weeks. Oral antibiotic therapy was continued with clindamycin for a further 12 weeks for treatment of chronic osteomyelitis. 6 months later the back pain had subsided completely and the inflammatory/degenerative changes had disappeared.

Case 6

A 63-year-old woman presented with persistent lower back pain for 5 weeks, without radiculopathy or neurological deficits. The inflammatory markers were slightly elevated (CRP 55.7 mg/l and leucocyte count within the reference range). An MRI of the spine showed degenerative changes and acute spondylodiscitis involving L2/3, but no intraspinal abscesses. A CT-guided biopsy was initially not diagnostic, leading to a transpedicular biopsy of the vertebra involved and a biopsy of the disc space. *P. micra* was isolated in all biopsies, although the initial biopsies showed growth only after a longer incubation period. Antibiotic therapy was started with amoxicillin / clavulanic acid intravenously for 14 days, followed by oral amoxicillin for 6 weeks.

An odontogenic focus was presumed, as the patient reported persistent inflammation of a molar following a dental procedure. A dental abscess was identified, with infiltration of the maxilla. Possible alternative foci were suggested by the patient reporting vaginal discharge and changes in bowel movements. Neither a gynaecological examination nor a colonoscopy revealed an infectious focus.

After completion of antibiotic treatment, the patient reported persistent lower back pain after five months. An MRI of the lower spine showed regression of the inflammatory changes. There were no signs of abscesses or other complications following the infection.

The six cases are summarised in [table 1](#) and *P. micra* susceptibility data in [table 2](#).

Discussion

Between 1 June 2012 and 31 May 2019, 278 patients were diagnosed with spondylodiscitis at our institution. During this period, *Parvimonas micra* was cultured from a total of 439 clinical samples, mainly originating from polymicrobial oropharyngeal and maxillofacial infections. Other common foci were bone and soft tissue infections in patients with chronic osteomyelitis arising from foot ulcers or decubiti, and in patients with pleural empyema. We reviewed all 439 samples and identified six patients with spinal infections: five cases with *P. micra* as the only pathogen involved, and one case with a mixed infection with *P. micra* and *Fusobacterium nucleatum*.

Common presenting symptoms in patients with vertebral infections were aggravated lumbar back pain with mild systemic inflammatory signs. The median age was 72 years (range 63–82 years). A predisposing condition was preexisting degenerative changes of the lumbar spine. Three of the six patients had undergone previous decompressive surgery, with an interval of between 2 and 11 years between the initial operation and the current infection. These findings have been previously described as risk factors for pyogenic spondylodiscitis in general and also, in other case reports, for spondylodiscitis by *P. micra*, as summarised in the review by van Duijvenbode et al. [5]

Recent dental procedures have traditionally been linked to infective endocarditis rather than to spondylodiscitis. Reviewing our cases and the literature on other spinal infections with *P. micra*, an association with dental infections and spondylodiscitis can be observed. In a recent systematic literature review, an odontogenic focus was suspected in 50% of cases [5]. In four of the six cases described here, a dental focus was the suspected source of infection, indicating a short interval between dental inflammation and the development of symptomatic spondylodiscitis.

Diagnosis was made based on the clinical picture, imaging studies (with CT and MRI) and microbiological culturing. In 4/6 cases the organism was detected in blood cultures drawn at admission. All patients had vertebral biopsies for microbiological diagnosis.

Establishing the correct diagnosis was not without its difficulties: due to infrequent isolation from spinal infections and the bacterium's growth requirements and slower growth, multiple attempts to establish the causing organism were required in some patients. In four cases, multiple biopsies were performed due to initially negative microbiological results. Longer incubation periods led to the detection of *P. micra* from multiple samples, confirming the potential of *P. micra* to cause pyogenic spondylodiscitis as the only pathogen.

Surprisingly, despite an afebrile state and mild inflammation at presentation, *P. micra* was isolated from blood cultures as frequently as from CT-guided biopsies. Blood cultures were positive in four of the six cases, indicating great value for patients with systemic inflammation in whom no immediate biopsy is performed. Bacteraemia was most prominent in patients with abscess (3/4 patients), suggest-

ing bacterial shedding from the abscess rather than prolonged bacteraemia from the initial focus. In our series, no concurrent endocarditis was diagnosed, supporting the hypothesis of intermittent bacteremia. The lack of positive blood cultures in the other patients could also be explained by lower bacterial loads or sampling errors.

Treatment consisted of surgery and intravenous antibiotics in 3/6 patients. The indication for surgery was either acute neurological compression or for abscess evacuation and drainage. Three of the six patients were treated with intravenous antibiotics only. All patients were initially treated with intravenous antibiotics, following treatment recommendations for uncomplicated infections. This treatment consisted of initial intravenous therapy with amoxicillin / clavulanic acid, followed by oral antibiotics directed against the pathogen for a total duration of 6 weeks [2].

The therapy was adapted where appropriate. Two patients had a complicated course, requiring adjustment of the antibiotic therapy. One of these patients died from the rupture of an aneurysm of the abdominal aorta. The remaining patients had a favourable course regarding infection. The main complaint following treatment was persistent back pain. However, due to the retrospective nature of the study and the limited data available, no accurate statement regarding outcome can be made.

The main limitation of our study is its retrospective approach: we could only describe cases with microbiological isolation of *P. micra*, and therefore we could have easily missed a substantial number of cases with either unsuccessful or missing microbiological samples. Microbiological reporting of mixed anaerobic infections without iden-

Table 1: Summary of cases.

Age Gender	Initial presentation	Comorbidities	Imaging CT / MRI spine	Surgical treatment	Antibiotic treatment	Microbiology	Primary focus of infection	Outcome
Case 1 82 years Male	Immobilising back pain and paraplegia Lc 9.8 G/l CRP 317 mg/l	Renal failure Gout Previous spinal surgery: decompression L1–L5	Spondylodiscitis L1–L3 Multiple epidural abscesses Abscess in the psoas muscle	Emergency decompression, laminectomy	i.v.: 5 weeks amoxicillin-clavulanic acid and meropenem	Blood cultures: <i>P. micra</i> (TTP 1 d 16 h 30 min) Abscess: <i>P. micra</i>	Evidence of dental infection with multiple tooth root granuloma	Death – cause unrelated to spondylodiscitis
Case 2 69 years Male	Lower back pain for 3 weeks Hypersensitivity left thigh Lc 8.8 G/l CRP 40 mg/l	Coronary heart disease Renal failure Diabetes mellitus II Previous spinal surgery: decompression and left discectomy L2/3	Spondylodiscitis L2/3 Paravertebral inflammation No abscess	None	i.v.: 2 weeks Amoxicillin-clavulanic acid Oral: 4 weeks amoxicillin	Blood cultures: negative CT-guided biopsy: <i>P. micra</i>	Probably dental focus: tooth extraction prior to infection TTE: no endocarditis	Persistent pain, less intensity at three years MRI: regression of inflammation, no abscess
Case 3 72 years Male	Lower back pain for 2 weeks Lc 7.5 G/l CRP 155 mg/l	Parkinson's disease	Spondylodiscitis L1/2 Abscess formation, paravertebral and epidural inflammation with compression	Debridement, discectomy, abscess evacuation	i.v.: 2 weeks amoxicillin-clavulanic acid and penicillin Oral: 4 weeks amoxicillin	Blood cultures: <i>P. micra</i> (TTP 2 d 13 h 48 min) CT-guided biopsy: <i>P. micra</i> Abscess: <i>P. micra</i>	Probably dental focus: recent dental procedure before onset of symptoms	No follow up at our clinic
Case 4 72 years Female	Lower back pain for 6 weeks Lc 9.2 G/l CRP 133 mg/l	Metastatic breast cancer with diffuse vertebral metastases	Spondylodiscitis T12/L1, Intraspinal abscess with spinal stenosis	Fenestration, abscess evacuation	i.v.: 5 weeks Amoxicillin-clavulanic acid Oral: 1 week moxifloxacin	Blood cultures: <i>P. micra</i> (TTP 1 d 2 h 24 min) Abscess: <i>P. micra</i> <i>F. nucleatum</i>	Focus unknown TTE: no endocarditis Dental examination: no active infection	Persistent back pain at 4 weeks MRI: persistent inflammation, resolution of abscess
Case 5 72 years Male	Lower back pain for 3 months Lc 6.2 G/l CRP 26 mg/l	Diabetes mellitus II Previous spinal surgery: decompression L3/L4	Degenerative changes L4/5, no clear evidence of infection Follow-up MRI (4 weeks later): progressive degenerative changes L4/5, paravertebral and epidural inflammation, no abscess	None	i.v.: 14 days Penicillin and er-tapenem Oral: 10 weeks clindamycin	Blood cultures: <i>P. micra</i> (TTP unknown) CT-guided biopsy: not diagnostic Open biopsy: <i>P. micra</i>	Focus unknown	No back pain at 6 months. MRI: regression of inflammation
Case 6 63 years Female	Lower back pain for 6 weeks Lc 14.8 G/l CRP 56 mg/l		Spondylodiscitis L2/3, no abscess	None	i.v.: 2 weeks Amoxicillin-clavulanic acid Oral: 4 weeks amoxicillin	Blood cultures: negative CT-guided biopsy: <i>P. micra</i> Open biopsy: <i>P. micra</i>	Evidence of dental infection: tooth root abscess with infiltration of maxilla Gynaecological examination: no focus of infection Colonoscopy: no focus of infection	Persistent pain, less intensity at 5 months MRI: regression of inflammation

Lc = leucocyte count; CRP = C-reactive protein; MRI = magnetic resonance imaging; CT = computerised tomography scan; i.v. = intravenous therapy; TTE = transthoracic echocardiogram; TTP = time to positivity; *P. micra* = *Parvimonas micra*

Table 2: Susceptibility testing of clinical isolates of *Parvimonas micra*.

Antibiotic	Case 1		Case 2		Case 3		Case 4		Case 5		Case 6	
	MIC (mg/l)	Interpretation*	MIC (mg/l)	Interpretation*	MIC (mg/l)	Interpretation*	MIC (mg/l)	Interpretation*	MIC (mg/l)	Interpretation*	MIC (mg/l)	Interpretation*
Penicillin	<0.002	S			0.002	S	0.006		<0.002	S	0.003	S
Amoxicillin			0.032	S					<0.016	S		
Amoxicillin / clavulanic acid	<0.016	S			0.016	S			<0.016	S		
Ceftriaxone	0.032	S			0.125	S			0.064	S		
Ertapenem									0.012	S		
Imipenem					0.016	S						
Clindamycin	0.25	S	0.038	S	0.38	S	0.19	S	0.125	S	0.19	S
Ciprofloxacin	0.38											
Moxifloxacin	0.19		0.125	S	0.25	S	0.38	S			0.094	S
Levofloxacin									0.094	S		
Metronidazole					0.125	S	0.125	S	0.016	S		
Daptomycin					0.38	S						
Rifampicin	0.003	S										

MIC = minimum inhibitory concentration; S = sensitive *Interpretation according to "The European Committee on Antimicrobial Susceptibility Testing. Breakpoint tables for interpretation of MICs and zone diameters. Version 9.0, 2019. <http://www.eucast.org>.

tification to species-level was not included in our review, potentially adding to the missed clinical cases.

Nevertheless, with this study we can contribute to the knowledge of invasive infections by *P. micra*. Spine and bone infections with this pathogen are rarely reported in the current literature and were also rarely observed in our analysis. To our knowledge, this is to date the largest case series of spondylodiscitis by *P. micra* from a single hospital.

Additionally, we believe that the constellation of odontogenic infection and subsequent back pain should suggest the possibility of a pyogenic spondylodiscitis. In this context, an anaerobic infection seems more likely and a microbiological evaluation, including blood cultures and anaerobic cultures of biopsies, is strongly encouraged, as this could potentially lead to a narrower spectrum of antibiotic treatment.

Disclosure statement

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