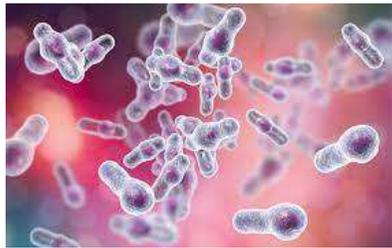


Réunion bibliographique CRIOGO - Mardi 1^{er} février 2022



Infections ostéo-articulaires à *Clostridium* spp.

Pr. Vincent CATTOIR

Service de Bactériologie-Hygiène hospitalière, CHU de Rennes

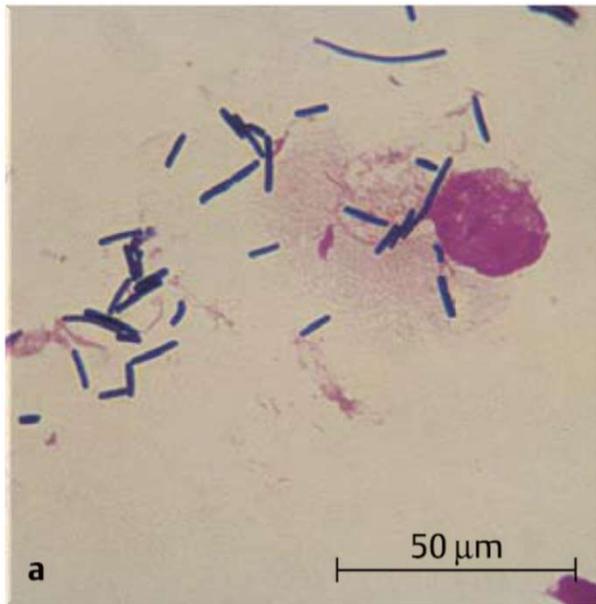
CNR de la Résistance aux Antibiotiques (laboratoire associé "Entérocoques")

Faculté de Médecine & Unité Inserm U1230, Université de Rennes 1



Genre Clostridium

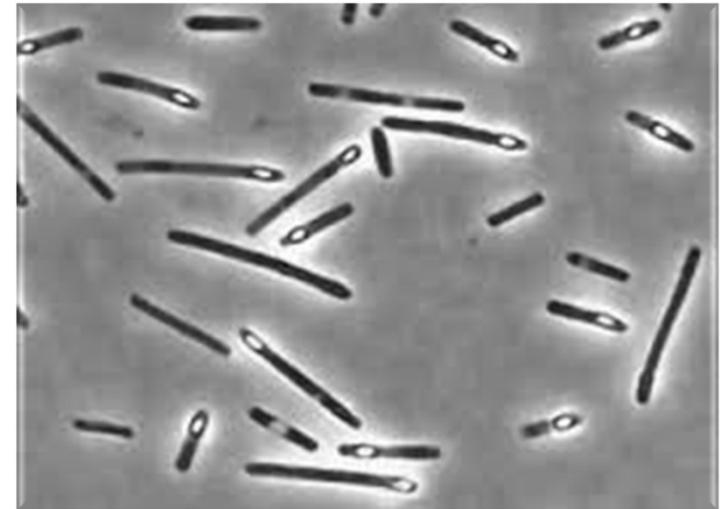
Bacilles à Gram positif



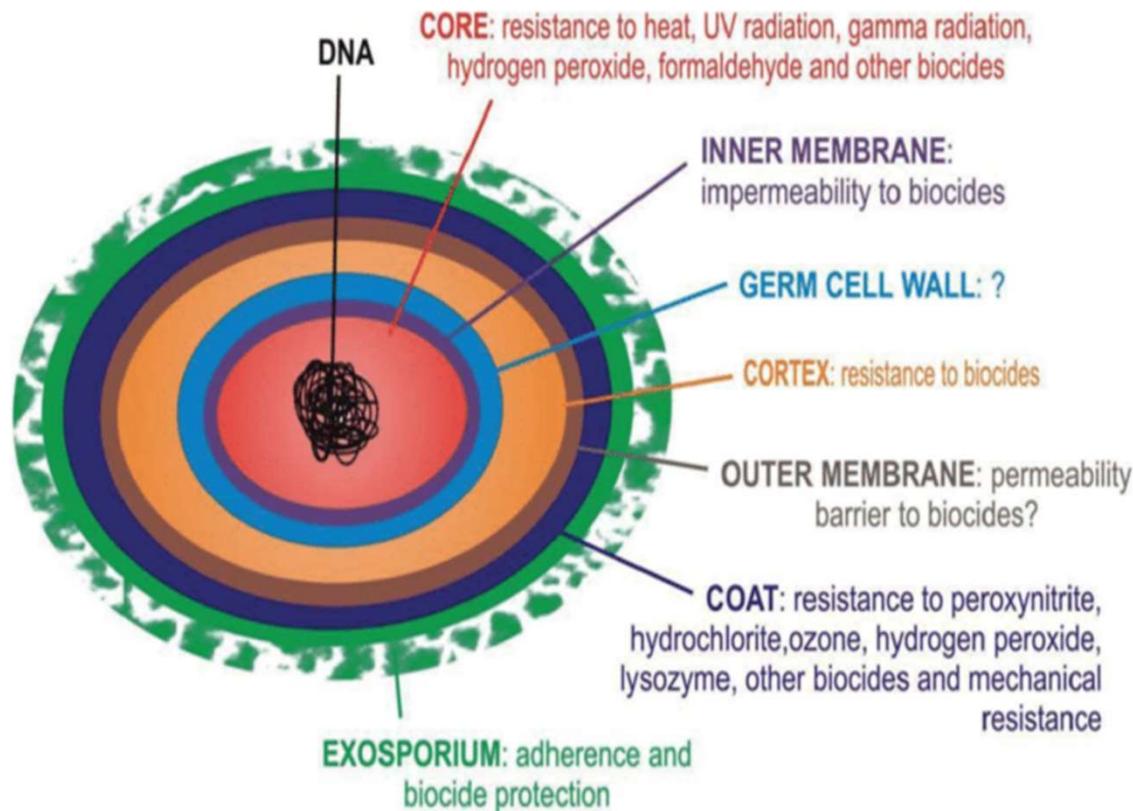
Anaérobies stricts



Sporulés



Spore = Forme de résistance



Resistance to disinfectants

High Resistance

-
- Prions (CJD, BSE)
 - Coccidia (*Cryptosporidium* spp)
 - Bacterial endospores** (*Bacillus* spp, *Clostridium difficile*)
 - Mycobacteria** (*Mycobacterium tuberculosis*, *avium*, *terrae*)
 - Cysts (*Giardia*, *Taenia* spp)
 - Small non-enveloped viruses (Poliovirus)
 - Trophozoites (*Acanthamoeba* spp)
 - Gram-negative bacteria** (*Pseudomonas* spp, *Escherichia coli*)
 - Fungi (including fungal spores) (*Aspergillus* spp, *Candida* spp)
 - Large non-enveloped viruses (Adenovirus)
 - Gram-positive bacteria** (*Staphylococcus* spp, *Enterococcus* spp)
 - Large lipid enveloped viruses (HIV, HBV)

Low Resistance

Taxonomie

Search: clostridium (368 results)

Show all results

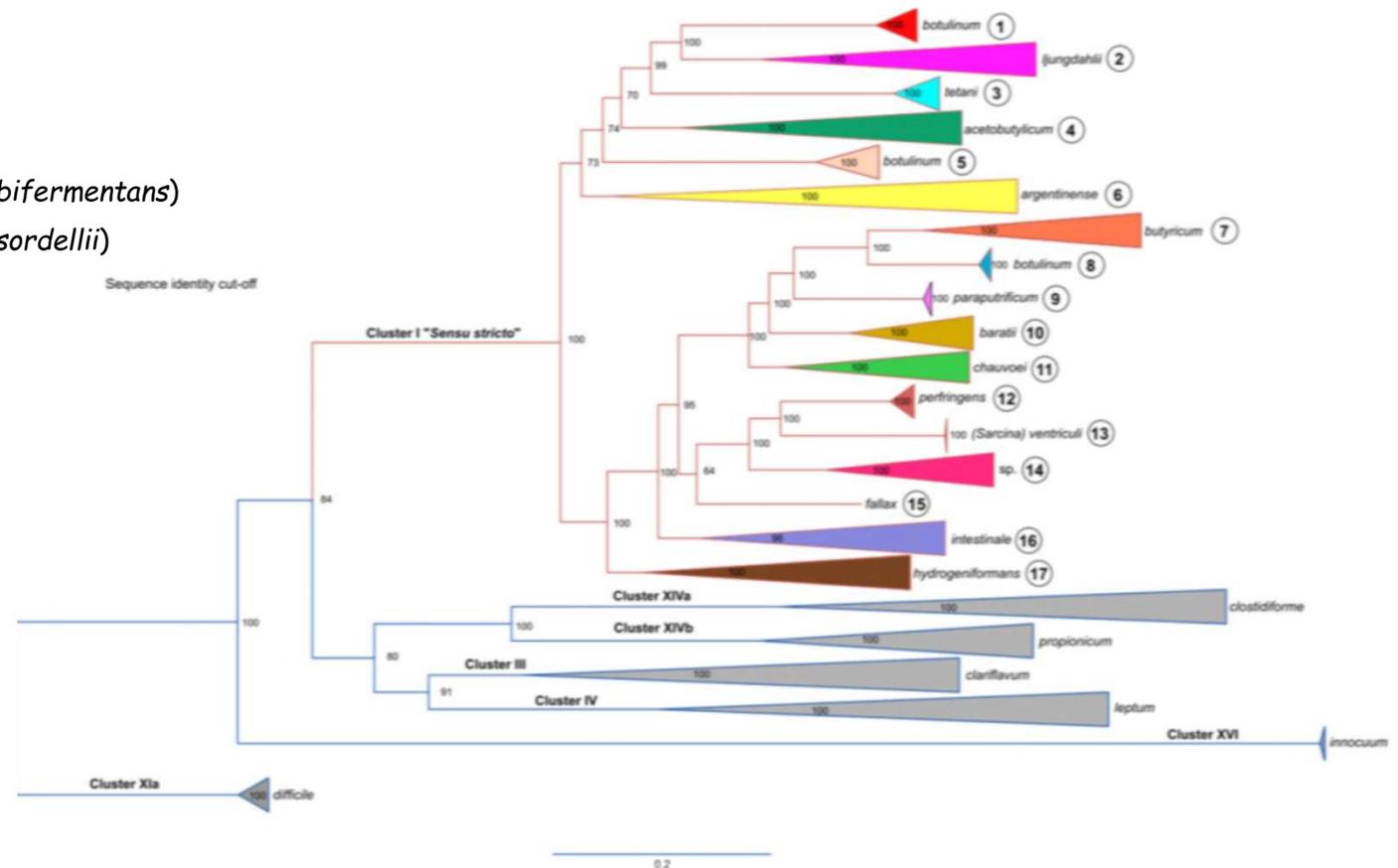
▼ genus (14)

- Clostridium** 154 espèces
- Paraclostridium** 2 espèces (dont *P. bifermentans*)
- Paeniclostridium** 2 espèces (dont *P. sordellii*)
- "**Peptoclostridium**"
- Peptoclostridium** 2 espèces
- Petroclostridium** 1 espèce
- "**Lachnoclostridium**"
- "**Pseudoclostridium**"
- "**Ruminiclostridium**"
- Ruminiclostridium** 7 espèces
- Thermoclostridium** 2 espèces
- Hungateiclostridium**
- "**Massilioclostridium**"
- "**Erysipelatoclostridium**"

► species (342)

► subspecies (12)

+ *Hungatella hatewayi*



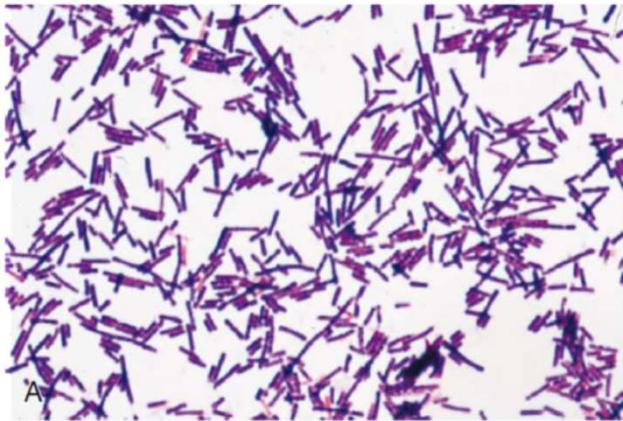
Espèces d'intérêt médical

TABLE 246-1 Clostridial Species Commonly Associated with Human Disease

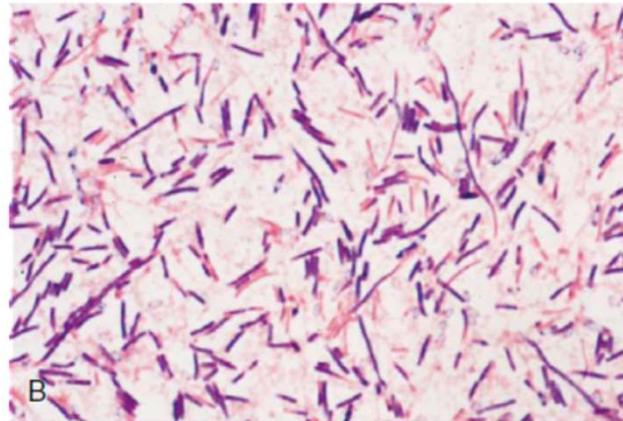
Species	Spore Location	Lecithinase Produced	Lipase	Enterotoxins Produced	Histotoxins, Hemolysins, Proteases	Neurotoxins Produced
Tissue Infections						
<i>C. perfringens</i>	ST, C	+	—	Yes	Yes	No
<i>C. ramosum</i>	T	—	—	No	Yes	No
<i>C. septicum</i>	ST	—	—	No	Yes	No
<i>C. sordellii</i>	ST	+	—	No	Yes	No
<i>C. bifermentans</i>	ST	+	—	No	Yes	No
<i>C. tertium</i>	T	—	—	No	Yes	No
<i>C. sphenoides</i>	ST	—	—	No	Yes	No
<i>C. baratii</i>	ST	—	—	No	Yes	No
<i>C. novyi</i>	ST	+	+	No	Yes	No
<i>C. histolyticum</i>	ST	—	—	No	Yes	No
Intoxications						
<i>C. difficile</i>	ST	—	—	Yes	Yes	No
<i>C. botulinum</i>	ST, T	—	+	No	Yes	Yes
<i>C. tetani</i>	T	—	—	No	Yes	Yes

Diagnostic microbiologique

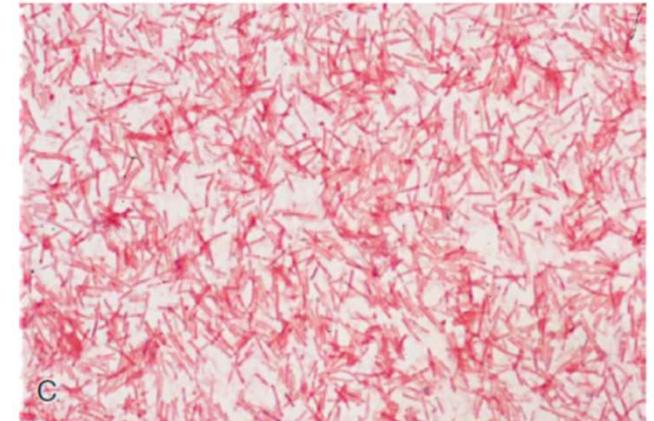
Coloration de Gram variable selon :
- l'espèce :



C. perfringens



C. novyi



C. ramosum

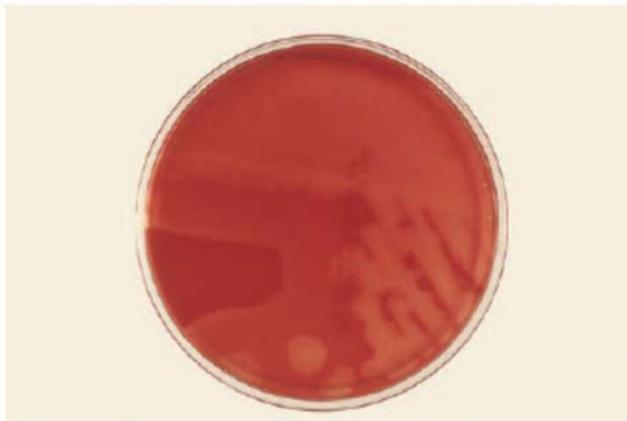
- l'âge des cultures :

Les espèces du groupe RIC (*C. ramosum*-*C. innocuum*-*C. clostridioforme*) peuvent apparaître Gram négatif en culture jeune

Diagnostic microbiologique

Croissance rapide (24 h) en anaérobiose

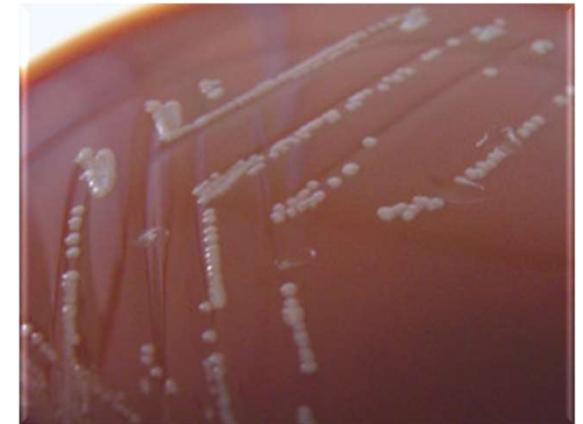
...ou sous 5 % de CO₂



C. perfringens



C. septicum



C. tertium
(*C. histolyticum*, *C. carnis*)

Identification souvent fiable avec la spectrométrie de masse MALDI-TOF

Sensibilité aux antibiotiques

Généralement sensibles aux pénicillines, céphalosporines (sauf *C. difficile*), glycopeptides et métronidazole

Résistances naturelles :

Clostridium spp. - *Eubacterium* spp. - *Peptostreptococcus* spp. : colistine, polymyxine B.

Clostridium aldenense, *Clostridium boltae*, *Clostridium citroniae* : fluoroquinolones dont moxifloxacine.

Clostridium clostridioforme : téicoplanine, dalbavancine, ramoplanine, fluoroquinolones dont moxifloxacine.

Clostridioides difficile : céphalosporines.

Clostridium innocuum : céfoxitine, vancomycine (bas niveau), daptomycine.

Clostridium lavalense : vancomycine (*vanB*).

Clostridium ramosum : céfoxitine, levofloxacine, et bas niveau pour vancomycine, linézolide et ramoplanine.

Hungatella hathewayi (ex *C. hathewayi*) : céphalosporines de 3^{ème} génération, fluoroquinolones dont moxifloxacine.

+ R aux aminosides, sulfamides et triméthoprime

Sensibilité aux antibiotiques



C. innocuum :

- R naturelle de bas niveau à la vancomycine (CMI = 8-32 mg/L)
- S à la tétracycline (CMI = 0,25-1 mg/L)

Sensibilité aux antibiotiques

Antimicrobial agent	CLSI MIC breakpoint (µg/ml) ^a		Species							
	Susceptible	Intermediate ^b	<i>C. bifementans</i>	<i>C. clostridioforme</i>	<i>C. difficile</i>	<i>C. perfringens</i>	<i>C. ramosum</i>	<i>C. septicum</i>	<i>C. sordellii</i>	<i>C. tertium</i>
Ampicillin ^c	0.5	1	100	67	26	100	100	100 ^d	100	100
Amoxicillin-clavulanate	4/2	8/4	100	75	100	100	100		100	100 ^d
Piperacillin-tazobactam	32/4	64/4	100 ^d		100	100	100		100	
Ticarcillin	32	64			100	100	100		100	
Clindamycin	2	4	100	90	56	100	82	100 ^d	94	100 ^d
Vancomycin	8	16	100	100	100	100	100	100 ^d	100	100
Imipenem	4	8	100 ^d		94	100	100		100	
Linezolid	2	4	100	86	91	100	12		100	100 ^d
Metronidazole	8	16	100	100	100	97	98	100 ^d	95	100
Trimethoprim-sulfamethoxazole	32	64	0	100	26	4	57	100 ^d	0	0 ^d

- Résistance à la pénicilline G, à l'amoxicilline et à la pipéracilline par production de β-lactamase (mise en évidence par nitrocéfine) décrite pour quelques souches de *C. butyricum*, *C. clostridioforme*, *C. ramosum* et *C. innocuum*
- Gène *vanB2* décrit chez plusieurs souches de *C. boltae*, *C. innocuum* et *H. hatewayi*

Infections chez l'homme

Clostridial species	Human disease(s)
<i>Clostridium aldenense</i>	Foot infection*
<i>Clostridium amygdalinum</i>	Chronic osteitis [§]
<i>Clostridium baratii</i>	Bacteremia [§] , botulism [§] , lung abscess [§]
<i>Clostridium bifermentans</i>	Endocarditis [†] , bacteremia [†] , visceral abscesses [§] , pneumonia and empyema [†] , panophthalmitis [†]
<i>Clostridium bolteae</i>	Bacteremia, necrotizing fasciitis, visceral abscesses, wound infection
<i>Clostridium botulinum</i>	Botulism (flaccid paralysis)
<i>Clostridium butyricum</i>	Botulism [§] , neonatal necrotizing enterocolitis [†] , sepsis [†]
<i>Clostridium cadaveris</i>	Bacteremia [†] , visceral abscess [†] , reactive arthritis [†] , pleural empyema [†]
<i>Clostridium carnis</i>	Septicemia [†]
<i>Clostridium celerecrescens</i>	Visceral abscess ^{†§}
<i>Clostridium chauvoei</i>	Gas gangrene ^{†§}
<i>Clostridium clostridioforme</i>	Intra-abdominal infection, skin infection, foot infection [†]
<i>Clostridium difficile</i>	Antibiotic-associated diarrhea, pseudomembranous colitis, osteomyelitis [†] , small bowel infection [†] , bacteremia [†] , visceral abscesses [†] , prosthetic device infections [†] , reactive arthritis [†]
<i>Clostridium fallax</i>	Septicemia [†] , soft tissue infection [†]

Clostridial species	Human disease(s)
<i>Clostridium glycolicum</i>	Wound infections, bacteremia, brain abscess, peritonitis
<i>Clostridium hathewayi</i>	Appendicitis, bacteremia, visceral abscess
<i>Clostridium neonatale</i>	Neonatal necrotic enteritis [†]
<i>Clostridium novyi</i>	Gas gangrene and other infections associated with injection-drug users, bacteremia, visceral abscess [§] , ocular infection [§] , myocarditis [†]
<i>Clostridium paraputrificum</i>	Bacteremia ^{††} , necrotizing enterocolitis ^{††} , pneumonia, mycotic aneurysm ^{††}
<i>Clostridium perfringens</i> (also known as <i>Clostridium welchii</i>)	Antibiotic-associated diarrhea [†] , infectious diarrhea, gas gangrene, food poisoning, necrotic enteritis
<i>Clostridium ramosum</i>	Bacteremia [†] , visceral abscesses, spondylodiscitis [†] , gas gangrene ^{††} , renal infection [†]
<i>Clostridium septicum</i> ^{††}	Gas gangrene ^{††} , endocarditis [†] , bacteremia [†] , visceral abscess ^{††} , osteomyelitis ^{††} , mycotic aneurysms ^{††} , necrotizing fasciitis ^{††}
<i>Clostridium sordellii</i>	Bacteremia, gas gangrene, toxic shock syndrome, soft-tissue infection, endophthalmitis [†] , endocarditis [†] , pneumonia [†]
<i>Clostridium spiroforme</i>	Diarrhea [†]
<i>Clostridium tertium</i>	Gas gangrene [†] , bacteremia [†] , septic arthritis [†] , visceral abscess [†]
<i>Clostridium tetani</i>	Tetanus (spastic paralysis)

IOA à anaérobies stricts

Table 3. Isolates from anaerobic joint infections.

Anaerobic isolate	No. of cases
<i>Bacteroides fragilis</i>	20
<i>Bacteroides</i> species	18
<i>Fusobacterium necrophorum</i>	75
<i>Fusobacterium</i> species	20
Other unidentified gram-negative bacilli	19
<i>Clostridium perfringens</i>	6
<i>Clostridium</i> species	7
<i>Propionibacterium acnes</i>	10
Anaerobic diphtheroids or corynebacteria	71
<i>Peptococcus magnus</i>	13
<i>Peptococcus</i> species	88
<i>Peptostreptococcus</i> species and anaerobic streptococci	9
Total	356

Table 1 Isolation of organisms from anaerobic in 26 children osteomyelitis

Organism (total number)
<i>Peptostreptococcus</i> sp. Anaerobic cocci (29)
<i>V. parvulla</i> (1)
<i>Clostridium</i> sp. (4) 5,4 %
<i>Fusobacterium</i> sp. (8)
<i>Bacteroides</i> sp. (2)
Pigmented <i>Prevotella</i> & <i>Porphyromonas</i> sp. (12)
<i>P. oralis</i> (3)
<i>B. fragilis</i> group (4)
<i>S. aureus</i> (3)
<i>Streptococcus</i> sp. (5)
<i>E. coli</i> (2)
<i>E. corrodens</i> (1)
Total

IOA à *C. perfringens*

Table 1 Characteristics and outcome data of 8 patients with bone and joint infection due to *Clostridium perfringens* according to the antibiotic regimen

Patient	Age/sex	Comorbidities	Clinical form	Sites involved	Bacteria	Number of intraoperative samples positive for <i>C. perfringens</i>	Antibiotic regimen	Duration of antimicrobial therapy	Outcome
Case 1	66/M	Diabetes, heart failure	Osteosynthetic device infection	T10-S1	<i>C. perfringens</i> <i>Staphylococcus stimulans</i> <i>Staphylococcus epidermidis</i>	3	Clindamycin + Rifampicin	12 weeks	Cured
Case 2	58/M	Tobacco use, chronic alcoholism	Osteosynthetic device infection	Femur	<i>C. perfringens</i> <i>Staphylococcus aureus</i>	2	Clindamycin + Rifampicin	12 weeks	Cured
Case 3	78/M	Chronic respiratory disease, Chronic renal failure, heart failure	Osteosynthetic device infection	Hip	<i>C. perfringens</i> <i>Candida albicans</i>	2	Clindamycin + Rifampicin + Fluconazole	4 weeks	Deceased
Case 4	76/F	Hypertension	Osteosynthetic device infection	Hip	<i>C. perfringens</i>	1	Levofloxacin + Metronidazole	12 weeks	Cured
Case 5	70/M	Diabetes	Prosthetic joint infection	Hip	<i>C. perfringens</i>	4	Clindamycin + Rifampicin then Metronidazole	8 weeks then 4 weeks Total duration = 12 weeks	Cured
Case 6	86/M	Active cancer	Prosthetic joint infection	Hip	<i>C. perfringens</i> <i>Proteus vulgaris</i> <i>Fingoldia magna</i> <i>Peptoniphilus harei</i>	5	Cotrimoxazole + Levofloxacin + Metronidazole then Clindamycin only	4 weeks then 8 weeks Total duration = 12 weeks	Cured
Case 7	34/M	HIV, cirrhosis	Chronic osteomyelitis	Radial bone	<i>C. perfringens</i>	3	Metronidazole	7 weeks	Cured
Case 8	67/M	Active cancer, stroke, chronic respiratory disease	Chronic osteomyelitis	Femur	<i>C. perfringens</i> <i>Staphylococcus aureus</i>	1	Amoxicillin-clavulanic acid + Rifampicin	6 weeks	Cured

IOAP à *Clostridium* spp. (autres que *C. perfringens*)

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
References	1995, Pron B, et al., Eur J Clin Microbiol Infect Dis [3]	1999, McCarthy J, et al., J Infect [4]	2007, Morshed S, et al., J Arthroplasty [14]	2011, Burnell CD, et al., J Arthroplasty [15]	2012, Economedes DM, et al. BMC Infect Dis [16]	2013, Curtis L, et al., Surg Infect [5]	2013, Ranganath S, Midturi JK. Am J Med Sci [6]	2013. This case
<i>Clostridium</i> spp.	<i>C. difficile</i>	<i>C. difficile</i>	<i>C. cadaveris</i>	<i>C. septicum</i>	<i>C. septicum</i>	<i>C. difficile</i>	<i>C. difficile</i>	<i>C. difficile</i>
Patient age and sex	16-year-old man	83-year-old woman	60-year-old woman	87-year-old woman	74-year-old man	61-year-old woman	47-year-old woman	61-year-old man
Manifestation	Delayed (16 months later)	Delayed (12 months later)	Delayed (9 months later)	Late (11 years later)	Early postoperative (2 weeks later)	Early postoperative	Early postoperative (3 months later)	Early postoperative (1 week later)
Site of prosthesis	Knee	Hip	Hip	Knee	Knee	Knee	Shoulder	Hip
Origin of infection	Iatrogenic contamination	After antibiotic-associated diarrhea	No information	Association with gastrointestinal malignancies	Association with gastrointestinal malignancies	Surgical procedure or hematogenous spread from an asymptomatic colon	Contamination from the environment or hematogenous spread via intestinal translocation	Hematogenous spread via intestinal translocation
Soft tissue	Local inflammation	Tenderness and swelling over the suture line	Swelling, erythema and warmth	Swelling and warmth	Acute swelling and redness	Tenderness and swelling	Tenderness and mild erythema overlying the joint	Purulent discharge of the wound
Comorbidities	Osteosarcoma of the femur and recent chemotherapy, closed fracture of his patella	Nosocomial pneumonia, <i>C. difficile</i> -associated diarrhea	Metastatic breast cancer	Gastrointestinal malignancy: adenocarcinoma	Colon cancer: adenocarcinoma	No comorbidities	Hypothyroidism, alcoholic hepatitis, marijuana	HIV-1, CMV disease, diabetes mellitus
Bacteremia	No	No	No	No	Yes	No	No	Yes
Diarrhea	No	Yes	No	No	No	No	No	No
Type of surgical treatment	(1) External arthrotomy with drainage (2) Removal of the implant	Revision of the hip and removal	Debridement and prosthesis retention	(1) Knee debridement (2) Removal of the prosthesis	(1) Irrigation, synovectomy, debridement and polyethylene exchange (2) Aggressive debridement with removal of implants	Removal of her second artificial knee	Surgical debridement with complete removal of the hardware	Retention with debridement
Antibiotics used	Amoxicillin/ornidazole/rifampicin/lincomycin/penicillin G	Metronidazole	PenicillinG/cefazolin/clindamycin	Cefazolin/metronidazole	Vancomycin/penicillin G	Piperacillin-tazobactam/metronidazole	Vacomycin/metronidazole	Vancomycin/metronidazole
Outcome	Amputation	Successful	Successful	Died of her underlying disease	Reinfected total knee arthroplasty 9 months later	Amputation	Unknown	Successful after two year of follow-up

IOA à espèces rares de *Clostridium*



Oxford Medical Case Reports, 2020;8,256–258

doi: 10.1093/omcr/omaa057

Case Report

CASE REPORT

Infection of a prosthetic knee joint with *Clostridium bifermentans*

Lisa F. Barrett, DO^{1,*}, Sailaja Devi Saragadam², Christina N. DiMaria, DO¹ and Alejandro Delgado-Daza, MD³

Abstract

We present the first reported case of prosthetic joint infection caused by *Clostridium bifermentans*, which was treated with total joint washout and debridement allowing for the patient to retain his prosthesis and achieve full recovery. *Clostridium bifermentans* is a gram-positive, anaerobic, spore-forming bacterium. This organism was once considered to be non-pathogenic, but has recently been associated with cases of septic arthritis, empyema, osteomyelitis, soft tissue infection, brain abscess, bacteremia and endocarditis.

Seminars in Arthritis and Rheumatism 45 (2016) 617–620

Septic arthritis due to *Clostridium ramosum*

Antonio García-Jiménez, MD^a, Núria Prim, MD, PhD^b, Xavier Crusi, MD^a,
Natividad Benito, MD, PhD^{c,d,e,*}

BMJ Case Rep 2015. doi:10.1136/bcr-2014-209169

Reactivation of *Clostridium tertium* bone infection 30 years after the Iran–Iraq war

Emilie Viro, ¹ Elvire Servien, ^{1,2} Frederic Laurent, ^{1,2,3} Tristan Ferry, ^{1,2,3} on behalf of the Lyon Bone and Joint Infection Study Group

The Journal of Arthroplasty Vol. 22 No. 2 2007

Case Report

Clostridium cadaveris Septic Arthritis after Total Hip Arthroplasty in a Metastatic Breast Cancer Patient

Saam Morshed, MD, MPH,* Farbod Malek, MD,*
Robert M. Silverstein, MD,† and Richard J. O'Donnell, MD*

Anaerobe 48 (2017) 56–58

First described case of prosthetic joint infection with *Clostridium disporicum*

Joseph A. McBride ^{a,b,*}, Alana K. Sterkel ^c, William M. Rehrauer ^c, Jeannina A. Smith ^a

Anaerobe 56 (2019) 46–48

Case report

Native joint septic arthritis due to *Clostridium tarantellae*

Aurélie Cointe ^{a,b,*}, Gauthier Péan de Ponfily ^a, Anne-Lise Munier ^c, Marwa Bachir ^c,
Hanaa Benmansour ^a, Anne-Claude Crémieux ^c, Marine Forien ^d, Aline Frazier ^e,
Elie Krief ^f, Emmanuelle Cambau ^{a,b}, Hervé Jacquier ^{a,b}

Anaerobe 57 (2019) 32–34

Case report

Clostridium septicum arthritis in a young infant: A case report

Pragati Grover ^a, Kiran Bala ^a, Jayashree Muralidharan ^b, Archana Angrup ^{a,*}, Pallab Ray ^a

Anaerobe 45 (2017) 138–141

The first human clinical case of chronic osteomyelitis caused by *Clostridium hydrogeniformans*

Jun Hirai ^{a,b,c,*}, Daisuke Sakanashi ^b, Ji Young Huh ^d, Hiroyuki Suematsu ^b,
Mao Hagihara ^b, Hideo Kato ^b, Yuka Yamagishi ^{b,c}, Jiro Fujita ^a, Hiroshige Mikamo ^{b,c}

Ostéomyélites à *Clostridium* spp.

Table 1. A summary of published cases of Clostridial osteomyelitis

Paper	Clostridium species	Type of infection	No. of cases
Mormeneo Bayo et al. 2020	<i>Clostridium celerecrescens</i>	Fracture related infection	1
Tremp et al. 2020	<i>Clostridium</i> spp.	Fracture related infection	1
	<i>Clostridium butyricum</i>	Fracture related infection	1
Vijayvargiya et al. 2019	<i>Clostridium paraputrificum</i>	Septic arthritis and osteomyelitis	1
Abusnina et al. 2019	<i>Clostridium sporogenes</i>	Osteomyelitis	1
Hirai et al. 2017	<i>Clostridium hydrogeniformans</i>	Fracture related infection	1
Perkins et al. 2017	<i>Clostridium sphenoides</i>	Fracture related infection	1
Mutoh et al. 2015	<i>Clostridium innocuum</i>	Osteomyelitis	1
Virost et al. 2015	<i>Clostridium tertium</i>	Osteomyelitis	1
Ibnoukhatib et al. 2012	<i>Clostridium</i> spp.	Fracture related infection	12
Mischuk et al. 2011	<i>Clostridium celerecrescens</i>	Fracture related infection	1
Taylor et al. 2010	<i>Clostridium argentinense</i>	Fracture related infection	1
Jiang et al. 2009	<i>Clostridium glycolicum</i>	Fracture related infection	1
Tekaya et al. 2008	<i>Clostridium clostridiiforme</i>	Vertebral osteomyelitis	1
Kihiczak et al. 1999	<i>Clostridium septicum</i>	Osteomyelitis	1
Shetty et al. 1998	<i>Clostridium septicum</i>	Osteomyelitis	1
Scanlan et al. 1994	<i>Clostridium bifermentans</i>	Osteomyelitis	1
Spitzer et al. 1991	<i>Clostridium clostridiiforme</i>	Osteomyelitis	1
Brook et al. 1993	<i>Clostridium</i> spp.	'Bone infection'	1
Neimkin et al. 1985	<i>Clostridium septicum</i>	Osteomyelitis	1

31 cas

Ostéomyélites à *C. celerecrescens*

Rev Esp Cir Ortop Traumatol. 2020;64(4):281-285

A review of difficult-to-treat post-traumatic osteomyelitis: Role of *Clostridium celerecrescens*[☆]

S. Mormeneo Bayo^{a,*}, I. Ferrer Cerón^a, P. Martín Juste^b, J. Lallana Dupla^b,
M.I. Millán Lou^a, J.M. García-Lechuz Moya^a

5 cas d'ostéomyélites post-traumatiques à *C. celerecrescens*
Espèce non identifiée par MALDI-TOF (ARNr 16S)
Antibiothérapies complexes
Persistance au cours du temps :



Figure 1 Course of disease caused by *Clostridium celerecrescens* in post-traumatic osteomyelitis.

Ostéomyélites à *C. celerecrescens*

Reference	Age/sex Underlying disease	Source	Microbiological findings	MIC (µg/mL)	Antibiotic treatment	Result
Perkins et al. ⁸	20/H. None	Grade II fracture of right radius and ulna	<i>C. sphenoides</i> (MALDI), <i>C. celerecrescens</i> (16S rRNA) and <i>C. sphenoides</i> (SM)	Penicillin = 3 Piperacillin (only if specified as S) Vancomycin = 1.5 Daptomycin = .25 Clindamycin >256 Metronidazole (only if specified as S) Amoxicillin-clavulanic acid = 2 Clindamycin = 2	1. Trimethoprim-sulfamethoxazole, cephalexin, and Clindamycin (with no improvement) 2. Vancomycin and ampicillin/sulbactam 3. Daptomycin and Piperacillin/tazobactam 4. Ampicillin/sulbactam (6 weeks) 5. Amoxicillin-clavulanic acid (3 months)	Cure
Mischnik et al. ³	55/M. DM, PAD, alcoholism	In 2000, grade III open fracture of tibia	2000: spore-forming bacteria (with no more information) 2001: MSSA Following 8 years with no symptoms 2009 and 2010: <i>C. clostridioforme</i> (API), <i>C. sphenoides</i> (MALDI-TOF) and <i>C. celerecrescens</i> (16S rRNA)	Imipenem = 2 Metronidazole = .06	2009: 1. Cefuroxime iv (1500 mg 3 times/day)+ Metronidazole iv (400 mg 3 times/day) for 15 days 2. Topical clindamycin 3. Non-specific oral therapy for 6 weeks 2010: Cefuroxime (1500 mg, 3 times/day)+Metronidazole (400 mg, 3 times/day) 1g amoxicillin + clavulanic acid, 3 times/day for 7 days	Cure
Bouvet et al. ²	20/H. None	Traumatic wound chopping wood	<i>C. clostridioforme</i> (rapid 32A strips) and <i>C. celerecrescens</i> (16S rRNA)	Amoxicillin-clavulanic acid = .75 Moxifloxacin = .38 Vancomycin = 1.5 Not specified	1g amoxicillin + clavulanic acid, 3 times/day for 7 days	Cure
Glazunova et al. ⁹	45/H	Open femur fracture after a fall	First <i>Enterobacter cloacae</i> was isolated. One month later, <i>Eubacterium limosum</i> was identified with the API-20A galleries Identified as <i>C. celerecrescens</i> by 16S rRNA testing	Not specified	Ciprofloxacin (500mg × 3, 3 times /day) and ceftriaxone (2 g/day) for <i>E. cloacae</i> Sulfamethoxazole (800mg × 6/day), trimethoprim (160mg × 6/day), Clindamycin (600mg × 2/day) and Metronidazole (250mg × 2/day) for <i>C. celerecrescens</i>	Cure
Mormeneo Bayo et al.	39/F	Open fracture of femur after a car crash	<i>Lelliottia amnigena</i> + <i>Clostridium</i> spp.	Penicillin = 4 Ampicillin ≤4 AMC ≤4 TZP = 16 Imipenem = 8 Metronidazole ≤4 Clindamycin >256 Vancomycin = 0.5	Ertapenem then levofloxacin; Imipenem + metronidazole; Dalbavancin + doxycycline; Cefoxitin + daptomycin + metronidazole; Daptomycin + AMC; Dalbavancin + AMC	

Conclusion



- IOA à *Clostridium* spp. rares
- Croissance généralement facile en 24 h sous anaérobiose
- Bactéries souvent multi-sensibles aux ATB



- Résistances naturelles et acquises de certaines espèces
- Diagnostic quelque fois délicat (ex. *C. celerecrescens*)
- Infections persistantes (spores) → rechutes après plusieurs années