Background

*Mycoplasma hominis* (*M. hominis*) belongs to the Mycoplasmatales order, prokaryotes that lack a cell wall. This characteristic has implications for antibiotic therapy because many commonly used antibiotics act by inhibiting the bacterial cell wall synthesis. Mycoplasma organisms have fastidious growth requirements and are often difficult to culture on a cell-free medium. A recent analysis of the *M. hominis* genome sequence revealed that it is the second smallest genome among self-replicating free living organisms with a theoretical minimal genome of 256 genes.[1] *M. hominis* is an opportunistic organism that is rarely associated with infection in humans. However, it is frequently isolated from the urogenital and respiratory tract of asymptomatic healthy persons [2]. Infants may be colonized during vaginal delivery, although colonization is usually short lived. *M Hominis* is rarely recovered from urine or genital samples in prepubertal children. Colonization in postpubertal individuals results mainly from sexual contact. [3]

*M Hominis* exceptionally penetrate the submucosal layer, unless the patient is immunosuppressed or traumatized (through accident or instrumentation), in which case they can invade the bloodstream and disseminate to many different organs and tissues throughout the body, causing extragenital infections [4]. However, extragenital infections are uncommon in healthy patients, furthermore, cases of pneumonia are exceptional. We report a case of severe *M. hominis* infection, a bacteria recognized to be intrinsically resistant to macrolides. Knowing the antibiotic susceptibility profile of *M. hominis* is important in view of the increasing resistance to tetracycline and the emerging resistance to fluoroquinolones [5,6].

Case Presentation

A previously healthy 15-year-old sexually active female was admitted to our hospital because of dyspnoea, fever and right thoracic pain. The physical examination was
suggestive of right sided pneumonia and laboratory tests revealed a marked leukocytosis (39,800/mm$^3$ WBC, 89% neutrophils; 74% segmented and 15% bands) and an elevated C-reactive protein level (>250 mg/L). The chest X-ray confirmed the clinical suspicion of right lobar pneumonia and an outpatient treatment of oral clarithromycin (500 mg bid) was started by the treating physician. The absence of clinical improvement concurrent with the onset of a pleural effusion on the fourth day of clarithromycin therapy motivated the admission of the patient to the hospital and the addition of i.v. ceftriaxone (2 g bid) to the macrolide regimen.

High fever persisted however and a chest CT scan obtained on the seventh day of antibiotic treatment, showed a bilateral necrotizing pneumonia as well as a bilateral pleural effusion. At this time, on the basis of a presumed polymicrobial infection including anaerobes, a treatment of i.v. amoxicillin/clavulanate (2.2g tid) was substituted for the previous clarithromycin-ceftriaxone regimen.

Two days later the patient was eventually admitted in the paediatric intensive care unit because of her worsening condition and amoxicillin-clavulanic therapy was switched to imipenem-cilastatin (500 mg i.v. q6h) and vancomycin (750 mg i.v. q8h). Cultures of pleural effusion for aerobic and anaerobic pathogenic bacteria obtained by needle aspiration were negatives. *M. hominis* was then detected by eubacterial PCR [DNA extracts were amplified using PCR targeting the 16S rRNA as follows: forward primer (Bak11wF): 5’- AGTTTGATCMTGGCTCAG-3’, reverse Primer (Pc3mod): 5’-GGACTACHAGGGTATCTAAT-3’, sequencing primer: Bak11wf and Bak533 r: 5’-TTACCGCGGCTGCTGGCAC-] [3], and confirmed by a *M. hominis* specific Taqman PCR (270 million copies/mL), and further confirmed by specific culture (Mycoplasma IST, bioMérieux, France). The primers of the TaqMan PCR used were: Forward primer: 5’-TTTGGTCAAGTCTGCAACGA- 3’, Reverse Primer: 5’-
CCCCACCTTCCTCCAGTTA-3’ and probe: FAM – TTACTAACATTAAGTGGAGGACTCTA-MGB, targeting the M. hominis 16 rRNA gene sequence. The sensitivity of this test is excellent, since detect less than 10 copies per reaction (Pascual et al, unpublished)

The antibiotic susceptibility tests revealed resistance to macrolides and susceptibility to tetracyclines and quinolones, motivating the addition of doxycycline (100 mg twice a day) twelve days after her symptoms started.

A new CT scan showed a larger amount of pleural fluid as well as a pericardial effusion. Figure 1.

The pleural and pericardial effusions were evacuated by surgery and a chest tube was inserted. M. hominis DNA was also amplified in the pericardial fluid by specific PCR (85 copies/mL). Standard axenic cultures, and specific PCR assays for detecting Streptococcus pneumoniae and Staphylococcus aureus, as well as Legionella pneumophila antigen in urine samples turned out negative in all specimens. Complement fixation test failed to show specific immunoglobulin blood titers for Mycoplasma pneumonia infection.

Imipenem-cilastin and vancomycine were stopped while doxycline was continued during 2 weeks. This treatment was associated with clinical and biological improvement and the patient could be discharged from the ICU on day 19. At this moment the CRP level was down to 16 mg/L. Finally the patient fully recovered and no sequels were seen on the chest X-ray.

**Discussion**

We describe a case of severe pneumonia and pericarditis due to M. hominis in a previously healthy adolescent who completely recovers on doxycycline therapy. M. hominis was the sole pathogen isolated from the pleural and pericardial fluid. It was initially detected by a eubacterial PCR assay and eventually confirmed by a specific PCR assay and culture.
M. hominis may cause genital infections in adults and may be implicated in neonatal infections. It is also reported, mainly in immunosuppressed subjects, as the etiologic agent of serious extra-genital infections, such as brain abscess, pneumonia, mediastinitis, pericarditis, endocarditis, osteitis and arthritis, wound infections, peritonitis, and pyelonephritis [7-10]

However, cases are also reported in immunocompetent patients, particularly in individuals with predisposing factors such as trauma, poor cardiorespiratory function and complicated urogenital manipulations or surgery.

Previously reported cases of Mycoplasma hominis pneumonia in immunocompetent patients are summarized in table 1. [11-15]

In contrast to most previous reports, our case describes a disseminated Mycoplasma hominis infection in a healthy adolescent with no predisposing factor for extragenital infection such as trauma or mechanical ventilation. Mycoplasma hominis was isolated from two physiologically sterile sites, the pleural and pericardial cavities, and no other possible etiological pathogen was found, either by standard cultures, DNA amplification or serological testing. Furthermore, after presenting a worsening of her clinical condition on antibiotics active against common respiratory pathogens, our patient fully recovered when she received an antimicrobial treatment active against Mycoplasma hominis.

Mycoplasma hominis could be an underestimated cause of severe pneumonia in immunocompetent children, particularly when other common etiological agents have been ruled out in those not responding to standard therapy.

The Mycoplasma hominis strain isolated in our patient was susceptible to both tetracycline and quinolone antibiotics. These susceptibility tests were performed with a commercial assay for susceptibility determination in Mycoplasma hominis and Ureaplasma urealyticum. This assay is based on breakpoint cut offs which are set according to the
recommendations of the National Committee for Clinical Laboratory Standards.
Non-published data from our centre on the antibiotic susceptibility of *M. hominis* strains isolated from the genital and respiratory tracts between 2000 and 2008 are in accordance with data from the literature: 55% are susceptible to ciprofloxacin (5/9), 100% are susceptible to doxycycline (11/11), and 100% are resistant to clarithromycin (9/9).

*Mycoplasma hominis* is intrinsically resistant to macrolides [16-18], so that tetracyclines have been considered the drugs of choice for the treatment of *Mycoplasma hominis*. However, the therapeutic activity of tetracycline antibiotics may become unreliable due to the resistance phenomenon induced by previous antibiotic exposure, and they are no longer a valid therapeutic option in some areas [5,6]. As no resistance to levofloxacin (or other newer fluoroquinolones) and clindamycin is yet identified, these drugs could be a suitable therapeutic alternative [5,6,17,19,20]. The increasing resistance of *Mycoplasma hominis* strains to antibiotics makes guidance of therapy by in vitro susceptibility tests of paramount importance in invasive infections leading to life-threatening situations.

**Conclusions**

This case report shows that *Mycoplasma hominis* should be considered as a possible etiologic agent in a previous healthy and immunocompetent adolescent suffering a severe and complicated pneumonia not responding to macrolide and β-lactam agents.

The eubacterial PCR is a useful tool to detect unusual pathogens.

The efficacy of traditional drugs such as tetracyclines on *Mycoplasma hominis* is affected by increasing resistance, making susceptibility testing an important issue nowadays. The newest fluoroquinolones are an attractive option to treat invasive infections caused by *Mycoplasma hominis*. 
CONSENT
Written informed consent was obtained from the patient and her mother for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

COMPETING INTERESTS
The authors declare no competing interests

AUTHORS’ CONTRIBUTIONS
JC, MEP, GH, SDB, BV and AP: have been involved in patient clinical care, and in acquisition and interpretation of data.
MEP and AP have been involved in drafting the manuscript.
GG and KJ carried out the standard and specific microbiologic test and the molecular genetic studies.
GG and BV: have reviewed the manuscript.
All authors read and approved the final manuscript.

ACKNOWLEDGMENTS
We are thankful to Andrés Roby for helpful discussions, to Aline Wenger for her assistance in the microbiology identification and susceptibility testing, to Dr Jean Daniel Krähenbühl and Pascal Stucki for their careful review of the manuscript.
Reference List


LEGENDS OF FIGURE AND TABLE

**Figure 1.** CT Scan of the thorax showing bilateral necrotizing pneumonia (▲) and pleural effusion (◇) as well as pericardial effusion (✏). Note the presence of a chest tube (★) inserted into the pleural cavity (in communication with the lung abscess) and a drainage tube (☉) into the pericardial cavity.

**Table 1.** Summary of previously reported *Mycoplasma hominis* pneumonia in immunocompetent patients.
Figure 1.
Additional files provided with this submission:

Additional file 1: Table_review_litterature.docx, 17K
http://www.biomedcentral.com/imedia/3721278993699271/supp1.docx