

Nanobacteria-Like Particles in Human Arthritic Synovial Fluids

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We investigated the existence of nanosize particles in synovial fluids of rheumatoid arthritis and osteoarthritis patients. These specimens were cultured under mammalian cell culture conditions (37 °C; 5% CO₂/95% air) for a long period. After about 2 months, many nanoparticles appeared and they gradually increased in number and in size. The nanobacteria-like particles exist in synovial fluids of arthritis patients. The possibility of their existence and pathogenesis in various diseases should be verified cautiously.

Keywords: nanobacteria • arthritis • synovial fluid • rheumatoid arthritis • osteoarthritis • microorganisms

Introduction

During the past few decades, the discovery of nanobacteria has attracted much attention. Nanobacteria are small, self-replicating organisms that have been found in various natural environments, including deep-sea hydrothermal vents, mineral deposits, and even in human tissues. In 1996, Ferris et al. discovered nanobacteria in a hydrothermal vent sample from the Mid-Atlantic Ridge. Subsequently, nanobacteria were found in mineral deposits, such as hydrothermal vent fluids, and in human tissues, including the placenta and the lungs. The discovery of nanobacteria in human tissues has raised the possibility that these organisms may play a role in various human diseases, including arthritis. In fact, several studies have shown that nanobacteria-like particles are present in the synovial fluids of arthritis patients. These particles are small, spherical, and have a diameter of approximately 200 nm. They are thought to be composed of a protein shell and a DNA core. The presence of nanobacteria in synovial fluids has been reported in both rheumatoid arthritis (RA) and osteoarthritis (OA). In RA, the presence of nanobacteria has been associated with the production of autoantibodies and the formation of immune complexes. In OA, the presence of nanobacteria has been associated with the degradation of cartilage and the formation of osteophytes. The discovery of nanobacteria in synovial fluids has led to the development of new diagnostic and therapeutic approaches for arthritis. For example, the use of nanobacteria as a model for studying the pathogenesis of arthritis and the development of vaccines against nanobacteria are being investigated. In this study, we investigated the existence of nanosize particles in synovial fluids of RA and OA patients. These specimens were cultured under mammalian cell culture conditions (37 °C; 5% CO₂/95% air) for a long period. After about 2 months, many nanoparticles appeared and they gradually increased in number and in size. The nanobacteria-like particles exist in synovial fluids of arthritis patients. The possibility of their existence and pathogenesis in various diseases should be verified cautiously.

Materials and Methods

Synovial fluids were obtained from 66 patients with RA and 66 patients with OA. The patients were treated with NSAIDs and/or DMARDs. The synovial fluids were cultured in DMEM (GIBCO, Grand Island, NY) supplemented with 10% fetal bovine serum (FBS) (GIBCO) at 37 °C in 5% CO₂ atmosphere. After 2 months of culture, the cells were harvested and the culture supernatant was analyzed for the presence of nanobacteria-like particles. The particles were visualized by transmission electron microscopy (TEM) and their size was measured. The DNA content of the particles was determined by DNA quantification using a DNA quantification kit (BioLabs, Beverly, MA).

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Results

After 2 months of culture, the cells were harvested and the culture supernatant was analyzed for the presence of nanobacteria-like particles. The particles were visualized by transmission electron microscopy (TEM) and their size was measured. The DNA content of the particles was determined by DNA quantification using a DNA quantification kit (BioLabs, Beverly, MA). The results showed that nanobacteria-like particles were present in the synovial fluids of both RA and OA patients. The particles were small, spherical, and had a diameter of approximately 200 nm. They were composed of a protein shell and a DNA core. The presence of nanobacteria-like particles in synovial fluids of arthritis patients suggests that these organisms may play a role in the pathogenesis of arthritis. Further studies are needed to clarify the role of nanobacteria in arthritis and to develop new diagnostic and therapeutic approaches.

Discussion

The discovery of nanobacteria in synovial fluids of arthritis patients suggests that these organisms may play a role in the pathogenesis of arthritis. Further studies are needed to clarify the role of nanobacteria in arthritis and to develop new diagnostic and therapeutic approaches.



Figure 1. Right side; the OptiCell with synovial fluid from the RA patient. Synovial fluid was cultured with DMEM for about 22 months, and microparticles increased in size and caused the films to become obscured unevenly and resulted in a geographic pattern. Left side; the control OptiCell, which was filled with only DMEM, and not cultivated.

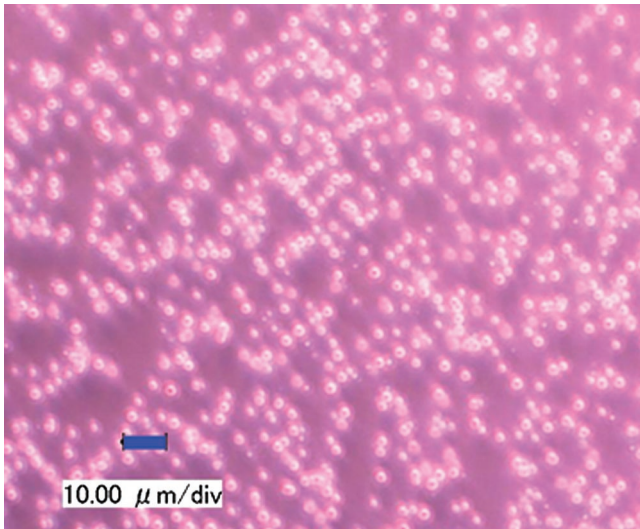


Figure 2. Microscopic photograph of microparticles of 10% synovial fluid from patients with RA after about 18 months of culture. Particles adhered to the inner surface of OptiCell. Blue bar = 10 μm. Original magnification, ×1000.

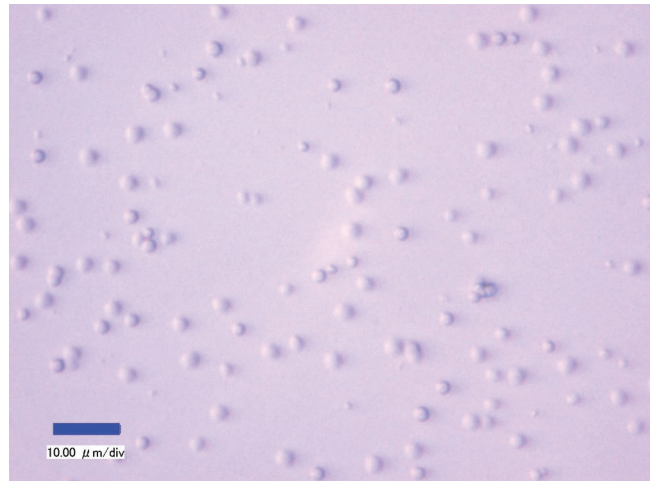


Figure 3. Microparticles from the same patient as in Figure 2 (after 22 months of culture). The size of these microparticles appeared to be less than about 2 μm. They were sphere or hemisphere and varied in size. Blue bar = 10 μm. Original magnification, ×3000.

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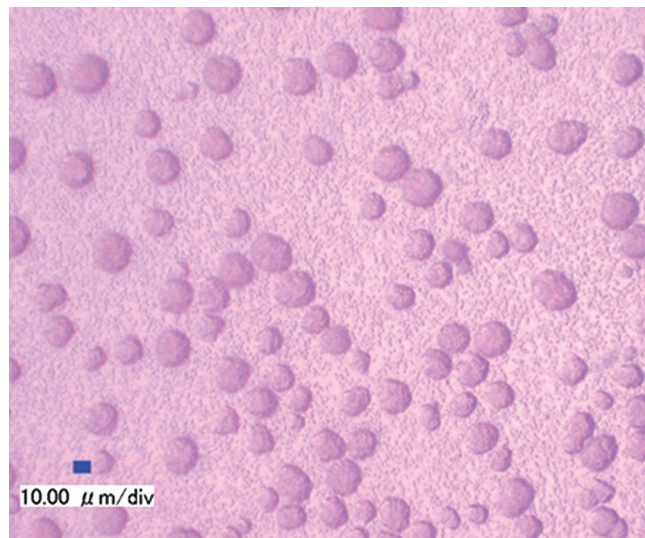


Figure 4. From the same patient as in Figure 2 (after 22 months of culture). Partially many particles appeared in large clusters with diameters greater than 10 μm. Blue bar = 10 μm. Original magnification, ×450.

RT-PCR), mRNA
 NB in 8% of
 NB in 61.4% of
 NB in 12% of
 NB in 9% of
 NB in 10% of

RT-PCR of 16S RNA of
 NB. Molecular
 NB in 10% of

Conclusion

NB in 10% of

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