Biopsy Needle System to Prevent P. acnes Contamination

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Technology description

Background

Infections are a potentially devastating complication of any surgery. Amongst the most devastating are post-surgical joint infections caused by Propionibacterium acnes (P. acnes), now considered the major microbial cause of surgical implant failures. Without early diagnosis and intervention, these infections result in joint tissue necrosis and implant loosening. Established infections typically require joint tissue debridement, complete implant replacement and prolonged antibiotic therapy to eradicate the infection. Aside from the risks of subjecting patients to additional surgeries, there are substantial costs associated with these interventions. While revision surgeries for joint infection represent only ~4% of shoulder joint surgeries, the complexity of these revision surgeries impose extended operating room and recovery times, and cost 3-5 times that of the primary surgery. If the primary and revision surgery costs are totaled, the ~4% patients undergoing revision surgeries for joint infections account for nearly 20% of the total health care bill for total shoulder arthroplasties. Unfortunately, early diagnosis of a P. acnes infected joint is currently difficult to achieve. These infections are typically diagnosed from a biopsy or aspirate taken from the potentially infected joint. A major barrier to accurate and timely diagnosis of a P. acnes joint infection is biopsy or aspirate contamination with bacteria in the skin, which include P. acnes.

Description of the Invention

To address this issue, we have designed a unique coaxial biopsy needle system to avoid skin contamination during joint biopsies or aspirate collections. Our proof of principle studies in novel 3D laboratory models of “infected” joint tissues indicate that our design effectively shields the collection needle from P. acnes in the overlying “skin” and facilitates the aseptic collection of aspirate from deeper “tissues”. We anticipate further optimization and modification of the current needle design using cadaveric shoulders to make it fully compatible with arthroscopic and other minimally invasive surgical techniques, and we have applied for federal funding support of our research through the Canadian Institutes of Health Research. We are looking for an industry partner to help us optimize our needle designs for commercialization, and to help us develop and incorporate a modified version of our rapid P. acnes detection technology (2016 Charles S. Neer Award1) into a combined technology that facilitates both aseptic collection and rapid detection of P. acnes in joints to promote timely diagnosis of joint infections.

1. Holmes S, Pena Diaz AM, Athwal GS, Faber KJ, O' Gorman DB. Neer Award 2017: A rapid method for detecting Propionibacterium acnes in surgical biopsy specimens from the shoulder. Journal of Shoulder and Elbow Surgery. 2017 Feb;26(2):179–185. doi:10.1016/j.jse.2016.10.001

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