

ASSOCIATION BETWEEN PROPIONIBACTERIUM ACNES AND FROZEN SHOULDER; A PILOT STUDY

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Introduction

Frozen shoulder was defined by Codman in 1934 but continues to be one of the most enigmatic conditions in orthopaedic surgery. No trigger has as yet been found for this condition.

An infective trigger had been considered as early as 1934 by Codman in his book when he compared frozen shoulder to tuberculosis of the shoulder. The early symptoms of pain and stiffness were similar yet tuberculosis left the joint destroyed but the joint surface was never destroyed in frozen shoulder. Over the next eighty years speculation about an infective trigger was dismissed as no organism was ever grown from a frozen shoulder.

Propionibacterium acnes (*P. acnes*) is an aerotolerant anaerobic gram positive bacterium that is a common skin commensal found on the face, shoulders and upper trunk in particular. This pilot study set out to investigate whether an infective agent such as *P. acnes* could be a trigger for the onset of this common, painful and disabling condition. The null hypothesis being that there is no relationship between infection and frozen shoulder.

Method

Surgical

12 patients were selected. They were all diagnosed clinically with frozen shoulder and undergoing arthroscopic capsular release as part of their normal treatment plan. During this operation samples of their shoulder capsule were taken, placed in Robertson's cooked meat (RCM) broth culture medium and sent to the microbiology laboratory.

Microbiological

After 7 days, broths were terminally subcultured onto chocolate agar (incubated in CO₂), blood agar (incubated in CO₂), and fastidious anaerobic agar (incubated anaerobically). Organisms were identified by standard methods and maldiTOF. Antibiotic sensitivities were determined according to the BSAC National Standard Method. In addition, samples of the RCM broth were aliquoted at 7 days, and sent to Micropathology Ltd for 16S RNA detection. RNA was extracted and amplified using a validated in-house assay. Any product amplified from the sample was sequenced and compared to known sequences available in Genbank using the BLAST tool.

Results

Of the 12 patients recruited 2 were excluded due to their diagnosis changing in light of findings at their operation.

Of the 10 remaining 6 were female. The average age was 51.3 (28-70)

The table to the right details the results of all patients. All those who tested positive for *P. Acnes* are highlighted in red

Study number	Capsule 1	Capsule 2
1	Negative	Negative
2	P. Acnes	P. Acnes S. Warneri
3	Negative	Negative
4	Bacillus	Negative
5	S. Hominis	P. Acnes S. epidermidis
6	P. Acnes	P. Acnes
7	Coag -ve Staph	Coag -ve Staph
8	P. Acnes	P. Acnes Coag -ve Staph
9	P. Acnes Corynebacterium	S. Epidermidis
10	Negative	P. Acnes S.Epidermidis

Discussion

The null hypothesis for this study was that infection is not associated with frozen shoulder; for no researcher had ever grown any organism in the eighty years since this disease was described. However the results of this pilot study were remarkable for eight of the ten patients had a positive culture from shoulder capsule tissue. In six patients this was Propionibacterium Acnes, one carried a Bacillus and in the eighth it was a coagulase negative Staphylococcus. Thus the null hypothesis had to be rejected.

The results of this study are extremely interesting but do not answer all the questions regarding frozen shoulder. However, it could be postulated that the reason frozen shoulder is common around the age of 50 years is due to the immune function decreases with increasing age, so called immunosenescence [27]. Or that at this age dental caries and gum disease allows anaerobic mouth and skin commensal organisms to gain access to the shoulder during normal bacteraemias. Maybe frozen shoulder is more common in diabetics because of their reduced resistance to infection? And maybe the reason that frozen shoulder rarely recurs is due to acquired immunity

Future Work

Having obtained these results and proven our method it has lead us to undertake a larger study with a control group. The control group will be patients undergoing shoulder stabilisations who are a clinically very different to patients with frozen shoulders.

