Can Making Skin Incision with Electrocautery Eliminate C. acnes from Surgical Wound During Shoulder Arthroplasty? A Prospective Randomized Clinical Trial

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INTRODUCTION:

C. acnes resides in sebaceous glands associated with hair follicles in the human skin. It has been postulated that *C. acnes* infection occurs during surgery through contamination by surgeon's gloves and instruments. When the skin is incised with a scalpel at the beginning of surgery, sebaceous glands in the skin are also cut open, releasing *C. acnes*. Subsequent touching and manipulation of the skin spreads *C. acnes* to other areas in the surgical field. Hydrogen peroxide and benzoyl peroxide have been shown to be more effective than the conventional skin prep methods, but as high as 17% of the cultures were still positive for *C. acnes* even with these new measures. Electrocautery, when used in the cutting mode, produces high temperatures, which heats and vaporizes cells rapidly. Many studies confirmed the safety of using electrocautery for making skin incision in various surgical procedures. Given the high temperatures generated at the tip of an electrode, it can be postulated that making skin incision with electrocautery can potentially heat and destroy exposed *C. acnes* on the incised skin surface. The purpose of this prospective randomized clinical trial was to test if making skin incision using electrocautery would result in decreased *C. acnes* contamination during shoulder arthroplasty. Our hypothesis was that making skin incision with electrocautery would result in significantly lower positive rates for *C. acnes* culture taken from the dermis of incised skin, surgeon's gloves, and forceps during shoulder arthroplasty than making skin incision with a scalpel.

METHODS: Patients undergoing primary anatomic or reverse total shoulder arthroplasty were randomized into 2 groups - Electro vs. Scalpel group. All patients' surgical area skin was wiped with 2% chlorhexidine gluconate cloths prior to OR entry. Cefazolin or Vancomycin was administered intravenously within 1 hour of skin incision. In OR, the skin was cleansed with 3% hydrogen peroxide, 7.5% povidone iodine solution, Isopropyl 70% Alcohol, followed by DuraPrep® (3M, St. Paul, MN). Adhesive antimicrobial incise drapes (Ioban®; 3M) were applied to the skin. A standard deltopectoral approach was used for all patients, with skin incision made using a #10 scalpel blade in the Scalpel group, and electrocautery in the Electro group. A swab culture from the dermis of the incised skin was obtained in both groups immediately after incision. Swab cultures of surgeon's gloves and forceps were taken immediately prior to humeral component implantation. Anerobic culture medium was used, and the samples were held for 14 days. Negative control culture (swab culture exposed to the operating room air for 5 minutes) was obtained in the first 23 patients. The primary outcome of the study is the proportions of positive *C. acnes* cultures from the dermis of incised skin.

RESULTS:

A total of 58 patients were enrolled with 29 in each group. The mean age was 69 years. There were 16 females with 8 in each group. With respect to dermis cultures, 7 patients in the Scalpel group (24%) were positive for *C. acnes*, whereas no patients in the Electro group (0%) were positive ($p < 0.001$). With respect to surgeon's glove cultures, both groups had 6 patients (20%) who were positive for *C. acnes*. With respect to forceps cultures, both groups had 4 positive patients (13%). All positive cultures were exclusively from male patients, whereas not a single female patient had positive cultures for *C. acnes*. The mean time to positive conversion of dermis cultures was 5.9 days in the Scalpel group, and there was no significant difference in positive conversion time between groups or between different cultures ($p>0.05$).

There were no wound healing issues or postoperative infection in the Electro group. The Scalpel group had one acute postoperative infection, which required further procedures. This patient had a previous open rotator cuff repair > 10 years ago, but his intraoperative cultures were all negative. There were 2 patients in the Electro group and 4 in the Scalpel group who had had a previous procedure in the ipsilateral shoulder. Among these patients, only 2 patients in the scalpel group had a positive *C. acnes* dermis culture. Nine patients from the Electro group and 11 from the Scalpel group had received at least one steroid injection to the ipsilateral shoulder prior to shoulder arthroplasty. Having previous injections and the time interval between injection and arthroplasty did not show any significant association with positive cultures ($p>0.05$).

DISCUSSION AND CONCLUSION:

Making skin incision with electrocautery resulted in zero positive dermis culture for *C. acnes*, whereas using a scalpel to make skin incision resulted in a 24% positive dermis culture rate. Despite this stark difference in the initial dermis culture result, *C. acnes* did grow in cultures taken later during surgery from surgeon's gloves and forceps in both groups. This finding suggests that the high temperature and spark generated by electrocautery have some apparent effect against *C. acnes* at the incised dermis at least temporarily. The source of *C. acnes* that grew in surgeon's gloves and forceps is unclear at this point, but it is unlikely to be contamination from OR instruments or personnel as none of the female patients in the 2 groups had positive cultures.

In conclusion, this study showed a potential antibacterial effect of electrocautery skin incision against *C. acnes*, but the problem of delayed *C. acnes* contamination of the surgical field remains and is yet to be addressed through future research.