2020

Antibiotic Efficacy in Lower Back Pain

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Abstract

- Chronic lower back pain affects approximately eight percent of the American population, yet no treatment has been agreed upon universally. Studies suggest that between 20-30 percent of lower back pain cases are caused by a low-virulence bacterial infection of an intervertebral disc.
- This scholarly project investigated: In patients with chronic lower back pain and Modic changes after disc herniation, what is the effect of antibiotic therapy on reducing pain symptoms compared to placebo.
- The literature review used the following electronic databases: ClinicalKey, Cochrane Library, Embase, and PubMed. Keywords and mesh terms refined searches to the most recent and relevant literature. The articles were then analyzed and refined, revealing ten for critical review. The studies are peer-reviewed and include a double-blind randomized control trial, pilot study, systemic literature reviews, literature reviews, monocentric study, and cohort study.
- Most of the research presented shows evidence that *Cutibacterium acnes* presence in intervertebral discs is not from contamination, but rather is an infectious process that occurs after disc herniation. Additional studies are required, but current research suggests that antibiotic therapy may be efficacious in reducing pain symptoms in those with chronic lower pain and Modic changes after disc herniation.

Retrieved from: https://www.nextavenue.org/wp-content/uploads/2015/05/lower-back-pain-try-strengthening-your-core_o.jpg

Statement of the Problem

- Chronic lower back pain has crippling effects on one's ability to perform daily living activities and reduces one's overall quality of life.
- Chronic pain can negatively influence personal, romantic, and work relationships.
- Narcotics are a controversial treatment that is not appropriate for all patients.
- A new theory suggests that when a disc bulge or herniation occurs, low virulence bacteria infect the injured disc causing chronic lower back pain and Modic changes.
- If bacteria are causing the pain, narcotics are only a temporary fix that can lead to dependence and addiction without treating the underlying cause of the pain. If a non-addictive alternative pill were available to take for a three-month regimen that would cure a lifetime of pain, it would be groundbreaking.
- Antibiotics are cost-effective and could reduce the need for invasive procedures and costly surgeries for those suffering chronic lower back pain with Modic changes after disc herniation.

Research Question

In patients with chronic lower back pain with modic changes after disc herniation, what is the effect of antibiotic therapy on reducing pain symptoms compared to placebo?

Literature Review

Pathogenic Features of Cutibacterium Acnes

- *Cutibacterium acnes* (C. acnes), formerly known as *Propionibacterium acnes*, is a normal flora described by Chen et al. (2016) as, "a bacterium that is microaerophilic, anaerobic, aerotolerant gram-positive bacilli present on the skin, conjunctiva, intestinal tract, external ear canal, and oral cavity" (p. 1291). Chen et al. (2016) theorized that *Cutibacterium acnes* gains access to intervertebral discs (IVDs) through the bloodstream via the oral cavity or broken skin.
  - C. acnes is rarely detectable in blood during the infectious process because it has a hard time reproducing and surviving in aerobic conditions like blood and muscle.
  - IVDs are sealed, not vascularized and protected by the annulus fibrosus
  - Once disc herniation occurs, neovascularization will occur to heal fissures of the annulus fibrosus structure.
    - It is hypothesized that this provides a pathway for C. acnes to invade both the annulus fibrosus and nucleus pulposus of the IVD, which is anaerobic, avascular and presents a perfect environment for C. acnes reproduction.
  - C. acnes is believed to cause a slow growing latent infection of intervertebral discs after herniation which leads to chronic lower back pain and Modic changes (bone edema on MRI).

Bacteria, Lower Back Pain and Modic Changes

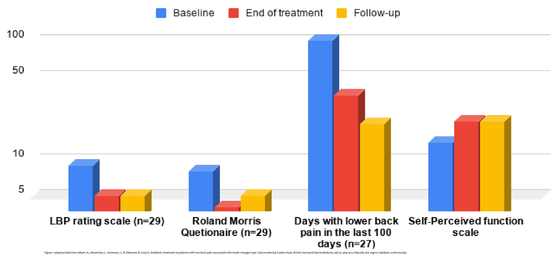
- Herlin et al. (2018) performed a systemic literature review looking for Modic changes (MCs), their association with lower back pain (LBP), and individuals' ability to perform activities.
  - 97% (30/31) of the articles reviewed compared Modic changes and lower back pain. Of those, 50% of the articles found a significant association between MCs and LBP.
  - The review concluded that the studies analyzed were inconsistent and an association between MCs and LBP could not be made.
- Tang et al. (2018) found a significant value (p= <0.001) showing an association between Modic changes and bacteria presence. All participants had a previous disc herniation.
  - 26.25% (21/80) of participants IVDs tested positive for C. acnes, and 18.7% (15/80) of those had Modic changes (bone edema) in adjacent vertebrae. A significant value (p= <0.001) was discovered, showing an association.
- Albert et al. (2013a) found a significant (p=0.00038) association between anaerobic bacteria and new Modic changes (bone edema) in patients.
  - 43% of total participants with disc herniation had anaerobic bacterial growth, and 80% of those had anaerobic bacteria isolated in the nucleus pulposus with new Modic changes to adjacent vertebrae.

C. Acnes Original Growth or Contamination

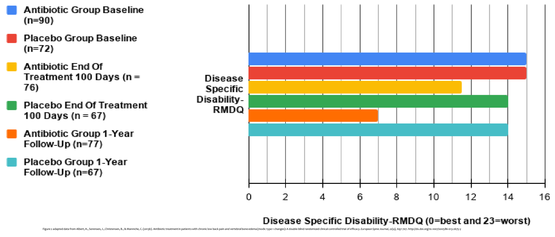
- Fritzell et al. (2019) concluded that *Cutibacterium acnes* presence is likely due to contamination from surrounding tissues due to the control group disc samples culturing a similar amount of C. acnes as the experimental group.
- Ahmed-Yahia et al. (2019) performed a monocenter study to explore if disc degeneration associated with modic changes is an infectious process caused by slow-growing low virulence bacteria.
  - A significant value (p=0.046) showed that the posterior (disc herniation group) surgical approach had significantly more positive C. acnes cultures than anterior approach. The study concluded that C. acnes presence was from contamination.
- Zhou et al. (2015) concludes that those with lower back pain after disc herniation whose IVDs were positive for C. acnes, is likely original growth and not contamination.
- Tang et al. (2018) found C. acnes was original growth and not contamination.
  - A significant value (p= 0.03) was found when comparing bacteria positive and negative samples. Participants with bacteria positive IVD samples were much younger than those who were negative.
- Yuan et al. (2017) provided evidence of original C. acnes colonization of IVDs by using Histologic examination (Gold Standard).
  - It was concluded that C. acnes was original growth and present in 21% of participants' IVD samples.
  - The identification allowed for the diagnosis of non-pyrogenic degenerated IVDs in 15 participants who had no discitis symptoms.

Efficacy of Antibiotics

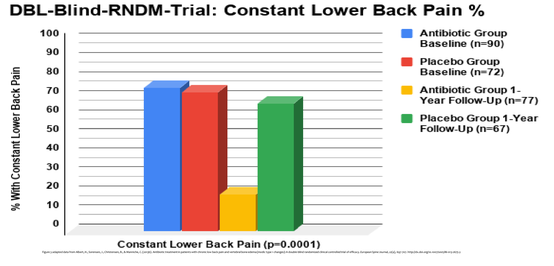
Pilot Study: Baseline, End of treatment, and Follow-up



DBL-Blind-RNDM-Trial: Disease Specific Disability-RMDQ



DBL-Blind-RNDM-Trial: Constant Lower Back Pain %



Acknowledgements

First and foremost, I would like to thank Abbey Ruland for providing a professional model for me to improve upon while also providing guidance and support during my clinical rotation. Thank Professor Sieg and Professor Metzger for the guidance provided that allowed me to improve my writing throughout this project. For statistical analysis, I would like to thank Theodore Chapman. Lastly, I want to thank my friends and family for providing support while I navigate the schooling required to become a physician assistant.

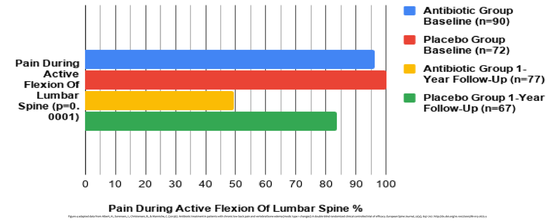
Discussion

We believe additional trials are needed to confirm Albert et al. (2007a & 2013b) study results. With the available data, antibiotic therapy was shown to improved pain symptoms compared to placebo in both studies by Albert et al. (2007a & 2013b). We conclude that additional research is still needed. However, it appears that antibiotic therapy is efficacious in specific patient subgroups suffering from chronic lower back pain with Modic changes after disc herniation.

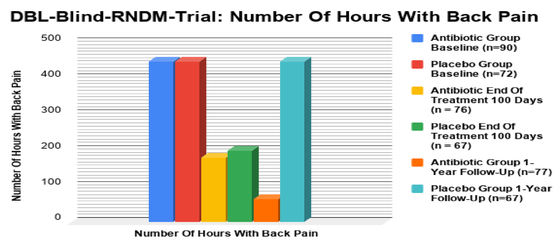
Applicability to Clinical Practice

- Aid clinicians in making informed decisions on whether to consider antibiotic therapy for patients with chronic lower back pain with Modic changes after disc herniation.
- Antibiotic therapy may be a cost-effective and safer option than narcotics and can potentially improve the lives of those living with chronic lower back pain with modic changes after disc herniation.

DBL-Blind-RNDM-Trial: Pain During Active Flexion Of Lumbar Spine %



DBL-Blind-RNDM-Trial: Number Of Hours With Back Pain



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