

## **RADIOLOGICAL STUDY USING STATIC MAGNETIC FIELD AND CONVENTIONAL TREATMENT TO TREAT ARTHRITIS IN RABBIT: COMPARATIVE STUDY.**

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### **ABSTRACT**

Fifteen rabbits were used in present study, all rabbits were infected with septic arthritis experimentally by injection *Staphylococcus aureus* ( $10^8$  diluted) in knee joint. Animals were divided into three groups, 1<sup>st</sup> group which was treated with static magnetic field 350 gauss/daily; 2<sup>nd</sup> group was treated with penicillin- streptomycin (antibiotics) and dexamethazone (anti inflammatory drug) daily and 3<sup>rd</sup> group was control group which leaved without treatment. After seven days, 1<sup>st</sup> and 2<sup>nd</sup> groups were not different in radiographic image and there were no degenerative change in the articular surface of the joints, but in control group we found degenerative change in the articular surface. In total white blood cell count of the synovial fluid, there were no significant change in 1<sup>st</sup> and 2<sup>nd</sup> group because of normal synovial fluid were founded in 1<sup>st</sup> and 2<sup>nd</sup> groups but in control the synovial fluid is turbid and containing high number of white blood cells. In conclusion both treatments (the magnetic field therapy and antibiotics and anti inflammatory treatment) were efficient and statically significant, so we can use the magnetic therapy as replacement to treat septic arthritis.

### **INTRODUCTION**

The electromagnetic field modalities have demonstrated therapeutic benefit for connective tissues (cartilage, tendons, ligaments, joints and bones), increase blood flow and metabolic activity, wound repair and chronic or acute pain relief. It is utilized for tissue growth and repair configured assuming the induced electric field was the source of stimulus (information) (1, 2)

Electromagnetic field accelerates the extracellular matrix synthesis and tissue regeneration (3)

It is present as alternative medicine to many pharmacological treatments with virtually no toxicity or side effects (1).

The mechanism of action of EMF signals at the molecular and cellular level is suggested ion / ligand binding in a regulatory cascade could be signal transduction pathway. (physiologically affective wave forms via tuning the electrical properties of exogenous EMF signals to endogenous electrical properties of ion binding. (1, 4).

Septic arthritis is inflammation of the synovial membrane and articular surface as a result of infection, it is characterized by varying degree of lameness, and a warm and swollen painful joint. The aetiological agent. *Streptococcus dysgalactiae*, *Escherichia coli*, *Erysipelothrix rhusiopathiae* and, *Staphylococcus aureus*, are common causes. (5)

most septic joint infections develops as a result of hematogenous seeding of the vascular synovial membrane due to bacteremic episode, or due to penetrating trauma or during joint surgery, a rare cases occur as a result of joint aspiration or local corticosteroid joint injection

In septic arthritis, synovial fluid is turbid, sometimes with flocculent material present. There is a reduction in viscosity, producing a watery consistency. Inflammation causes the protein content to rise and a stable froth is formed when shaken. The fluid will clot on standing.(6, 7)

A study reported ischemia in the bone occurs within 5 to 6 days after corticosteroid administration while electromagnetic field could prevent ischemia.8,9

The pathogenesis of acute septic arthritis depends on the interaction of the host immune response and the invading pathogen taking into the count steps of bacterial colonization, infection and induction of the host inflammatory response (9)

Magnetic field therapy can effectively alleviate cartilage destruction, shortens the disease course and enhance therapeutic effect in rabbits with arthritis (10), it is easy to apply, relatively painless and there is no need for direct stimulator-skin contact during its application (11).

The aim of this study to evaluate the effect of EMF on septic arthritis as an alternative treatment.

## **MATERIALS AND METHODS**

Fifteen mature rabbits were used in the present study of both sexes approximately 1.5 kg and healthy.

The animals were divided into 3 groups:

First group which contain four animals (magnetic group)

Second group which contain four animals (antibiotic group)

Third group which contain four animals (control group).

All animals were injected by  $10^8$  (dilution with broth) Staph aureus (which prepared from microbiology laboratory /veterinary medicine college, Basrah university) (12) intra articular knee joint and leave three days before the treatment to induce septic arthritis.fig (1)



Fig (1): knee joint of rabbit after 3 days of injection Staph aureus

- First group was applied 350 gauss/day daily for seven days
- Second group was treated with penicillin 40000 IU, streptomycin 50 mg /kg and dexamethazone 25mg / kg body weight. (13, 14)
- Third group was left without treatment

Magnetic field apparatus consist of five parts :

1-Power supply: this apparatus convert alternative current (AC) of electricity to direct current (220V,50 Hz to 30 V,0Hz).

2-Magnetic Coil: modified magnetic silk has these characteristic by( type grad P1/2L, H2, diameter 21mm). a coil has 1000 turns isolated by special plastic materials.

3-Analogue or digital Ammeter: to measure the output current from power supply.

4-compass : use to indicate the magnetic field (MF) direction

5-Modified Beds: these beds a local manufactured to restricts the rabbits during the treatment.(15)

The period of treatment with magnetic field given daily for seven days after induce septic arthritis.

X ray examinations were done after 7 days of each group. Joint capsule is aseptically prepared and a sample of joint fluid obtained using a sterile needle and syringe, synovial fluid was examined to estimate total WBC count.

## RESULTS

Both 1<sup>st</sup> and 2<sup>nd</sup> groups recovered well within one week of the treatment, clinically there were no signs of inflammation of the knee joints

X ray examination in both 1<sup>st</sup> and 2<sup>nd</sup> groups showed no signs of degeneration could be seen(in articular cartilage) (fig 2,3)

In the 3<sup>rd</sup> group there were degenerative lesion in the articular surfaces and slight widening of the joint space because of fluid accumulation.

In synovium samples , WBC total count in 1<sup>st</sup> and 2<sup>nd</sup> groups showed there was no WBC in the synovial fluid and the color was clear but in 3<sup>rd</sup> group the color is turbid and there was a significant number of WBC



Fig:(2) x ray of knee joint of treated group with magnetic field showing no any lesion in the articular surface after 7 day of treatment.



Fig:(3) x ray of knee joint of treated group with antibiotic and anti inflammatory drug showing no any lesion in the articular surface.



Fig:(4) x ray of knee joint of control group showed degenerative lesion in the articular surface (after 10 days of bacteria injection).

Tab 1 showing the synovial fluid analysis

Parameters	Magnetic group	Antibiotic anti inflammatory group	Control group
WBC	0.00	0.00	22.7±0.7cell/mm3
Color	Clear	Clear	Turbid

( $p \geq 0.05$  significant with 1<sup>st</sup> and 2<sup>nd</sup> groups)

## DISCUSSION

The experimental animals in all groups were showed in case of lameness after 3 days after injection of bacteria, as well as swelling and redness at knee joint, these signs was reveal to the inflammation of joint (septic arthritis) this result agree with (16) which induced unilateral septic arthritis in 12 rabbits by intra articular injection of *Staphylococcus aureus*.

The control group (was left without treatment), the clinical signs of a acute arthritis were disappeared after 5-7 days of the inflammation, while the synovial fluid reveal turbid and significant number of WBC cells in synovial analysis so the inflammation converted from acute to chronic arthritis, this result agree with (17) Infection can be a factor in chronic inflammatory conditions which affect joints . and also agree with( 18) who reported Most infected joint fluids have a striking degree of leukocytosis

The 1<sup>st</sup> group (magnetic treatment), clinical signs and radiographic images were indicated no degenerative lesion in knee joint, but the synovial fluid was small enough to total white blood cell count, there is no WBC in the synovial fluid and the color is clear this result agree with (10,19) electromagnetic field application produces biological effects, its causes anti inflammatory, analgesic and even antiseptic and antimicrobial changes through the increase of enzymes amounts and activities. And also agree with (20) that show the effectiveness of magnetotherapy in enhancing the antibiotic activity against certain pathogens.

2<sup>nd</sup> group (antibiotic and anti inflammatory treatment) clinical signs, radiographic image and synovium were similar to the 1<sup>st</sup> group in results this result agree with (21) which used potent anti inflammatory therapy with corticosteroids and appropriate anti microbial therapy to reduce septic arthritis. In conclusion there is no difference between both treatments so we can use electromagnetic field as a replacement treatment.

### دراسة إشعاعية باستخدام مجال مغناطيسي مستقر و العلاج التقليدي لعلاج التهاب المفصل في الأرانب: دراسة مقارنة.

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#### الخلاصة

في هذه الدراسة استخدمت 15 أرنب، استحدث التهاب مفصل انتاني مختبريا بواسطة حقن بكتريا المكورات العنقودية القحجية في مفصل الركبة. وقسمت الحيوانات إلى ثلاثة مجاميع: المجموعة الأولى عولجت باستخدام 350 كاوس كعلاج بالمجال المغناطيسي يوميا، المجموعة الثانية عولجت باستخدام المضادات الحيوية و مضاد الالتهاب (البنسلين- ستربتومايسين و دكساميثازون) يوميا و المجموعة الثالثة تركت بدون علاج كمجموعة سيطرة.

بعد 7 أيام، المجموعة المعالجة الأولى (العلاج المغناطيسي) و المجموعة الثانية (العلاج بالمضادات الحيوية و مضاد الالتهاب) في كل منها لم تظهر أي تغيرات في الصور الإشعاعية (لا توجد تغيرات تنكسية في الغضروف المفصلي)، لكن في مجموعة السيطرة وجد تغيرات تنكسية في غضروف المفصل. في الفحص لكريات الدم البيضاء الكلي، لا يوجد اختلاف بين المجموعة الأولى و الثانية بسبب السائل الزلالي الطبيعي لكن في مجموعة السيطرة السائل الزلالي عكر و يحتوي على عدد كبير من خلايا كريات الدم البيض. نستنتج إن المجموعتين متشابهتين في الكفاءة و الأهمية الإحصائية، لذلك يمكن استخدام المجال المغناطيسي كعلاج بديل لالتهاب المفصل الأنتاني.

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