INTERNATIONAL JOURNAL OF MEDICAL AND APPLIED SCIENCES
Earthjournals Publisher
E-ISSN:2320-3137
www.earthjournals.org

Research Article

ASSESSMENT OF USE OF ANTIBIOTIC IMPREGNATED BONE CEMENT BEADS/ INTRAMEDULLARY NAILS IN ORTHOPEDIC INFECTIONS

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Abstract

Introduction- Infection is one of the most dreaded complication in orthopedics, so the strive has always been there to prevent and control it. We used antibiotic loaded bone cement to treat these infections, which allows high concentration of antibiotics locally.Methods- We included 30 patients in our prospective observational case series study of orthopedic infections of extremities. All age and sex were included. There were 25 males and 5 females with mean age 35.8yrs (range 9-80yrs). We had 15 patients with infection in femur and 12 in tibia, remaining three were other site. Surgical debridement and application of antibiotic impregnated bone cement as nail or beads was done. Our aim was to find out time required for complete control of infection and to study its complications. Mean follow up was 22.2 wks(3-52 wks). Gentamicin and Vancomycin were the antibiotics used mostly. Results- 20(66.6%) out of 30 patients got complete control of infection in average 8.8 wks (3-18 wks, SD 5.6). There was reduction in clinical signs of infection in all patients, though adjacent joint stiffness of varying degrees remained an issue present in 57.14 % (17) patients. Complications seen were reinfection, refracture, difficult removal. Some patients didn't return for removal of implant.Conclusion- Antibiotic impregnated cement bead/nail is a good, simple and inexpensive treatment alternative in the armamentarium of surgeons to control orthopedic infections, especially if there is not much bone loss. The treatment modality should vary as per the requirements.

Keywords- Antibiotic, bone cement, orthopedic infections.

INTRODUCTION

Infection is one of the dreadest complication in orthopedics, so the strive has always been there to prevent and control it. Orthopedic infections are usually deep seated and difficult to control by simple means. This may require treatment involving multiple operative procedures leading to great discomfort and may incur heavy costs to the patient for complete treatment.

Options available for treatment of orthopedic infections include:

1) Multiple debridement surgeries and wound washes.[1]

2) Intravenous antibiotics for 3 weeks and oral antibiotics for many months.[1]

3) Illizarow's ring fixator application. [2,3]

4) Antibiotic impregnated cement beads\nail.[4,5,6]

5) Vascularised or nonvascularised bone graft\ skin flaps.[3]

Out of various options available, we are using antibiotics loaded bone cement to treat these infections in our research study, which allows high concentration of antibiotics to be administered to the areas of infection.[4] Moreover antibiotics levels in blood are sufficiently low, so as to avoid causing side effects. Hence this study, exploring this option of antibiotic mixed cement use for control of orthopedic infections

MATERIALS AND METHODS:

We included 30 patients in our prospective observational case series study performed at this tertiary care centre. All age and sex were included. All orthopedic infections of extremities were included. All compound fractures with high potential for infection were included. Infections of trunk and spine and head/ neck were excluded. Pts with infected nonunion and defect of more than two centimeters were excluded. There were 25 males and 5 females with mean age 35.8yrs (range 9-80yrs). We had 15 patients with infection in femur and 12 in tibia, remaining three were other site. Five patients had fresh compound fractures with severe contamination and remaining had established infection. Patients were admitted and investigated with X Rays, pus culture and sensitivity, blood investigations (TLC, DLC, ESR, BSL). After anesthesia fitness, surgical debridement and application of antibiotic (vancomycin and/or other antibiotic depending on sensitivity) impregnated bone cement(Polymethyl Methacrylate) implant was done.[7,8,9] In patients with long intramedullary infections antibiotic impregnated cemented nail were made as per the size of medullary canal diameter, and inserted.[8] In others antibiotic impregnated cemented beads were applied at the site of infection.[9] After the surgery post operative X rays were taken, intravenous antibiotics were given for just five days and dressings were continued till wounds healed. Our aim was to find out time required for complete control of infection and to study complications involved in the procedure. Case record forms, patient information sheet, and consent forms were prepared in English and local language. Time taken for control of infection and clinical findings at last follow up were noted. Mean follow up was 22.2 wks(3-52 wks).

General qualifications for a successful pairing of an antibiotic with bone cement include heat stability during the exothermic reaction, ability to diffuse in water, low potential for allergic reaction, and an appropriate spectrum against potential or confirmed organisms.[10] Gentamicin and Vancomycin were the antibiotics used mostly, they are bactericidal, has a dose-dependent killing curve, remains stable when exposed to heat and are soluble in water.[11] These four characteristics make them especially suited for use in bone cement. The substance is slowly eluted in the surrounding tissue in about 3-6 weeks. It allows high concentration of antibiotics to be administered to the areas of infection. Moreover antibiotics levels in blood are sufficiently low, so as to avoid causing side effects.[12]

Antibiotic dose used for hand-mixed antibiotic nails and beads per 40 g Polymethylmethacrylate powder was Tobramycin 1.2–4.8g, Vancomycin 1–6g, Gentamicin 40 mg–4.8 g and Cefazolin 4.5–6g.[10]

EVALUATON & RESULTS (Tables 1-7)

17(57%) out of 30 patients got complete control of infection in average 8.8 wks (3-18 wks, SD 5.6). There was reduction in clinical signs of infection in all patients, though adjacent joint stiffness of varying degrees remained an issue present in almost 57.14 % (17) patients. Four pts had reinfection. Two patients had refracture. Two were converted to Illizarow. six patients didn't return for removal of implant. There was lot of difficulty removing beads from soft tissue because of extensive fibrosis. In one patient tibia nail removal could not be done though pt came at 3mnths.

Table 1 Swelling at infection site at last follow up.

Swelling	Frequency	Percent
absent	18	60.0%
decreased	10	33.3%
present	2	6.7%
Total	30	100.0%

Table 2 Adjacent joint stiffness at last follow up.

Joint stiffness	Frequency	Percent
absent	13	43.3%
decreased	2	6.7%
increased	1	3.3%
fusion	3	10.0%
present	11	36.7%
Total	30	100.0%

Table 3 Pain at infection site at last follow up

Pain	Frequency	Percent
absent	18	60.0%
decreased	4	13.3%
present	8	26.7%
1Total	30	100.0%

Table 4 Fever at last follow up.

Fever	Frequency	Percent
absent	29	96.7%
present	1	3.3%
Total	30	100.0%

Table 5 Bone union status on X ray at last follow up.

Bone union	Frequency	Percent
not united	5	17.2%
united	19	65.5%
uniting	5	17.2%
Total	29	100.0%

Table 6 Infected discharge material from wound at last follow up.

Discharge	Frequency	Percent
absent	19	63.3%
decreased	6	20.0%
present	5	16.7%
Total	30	100.0%

Table 7 Wound status at last follow up

Wound status	Frequency	Percent
healed	17	56.7%
not healed	13	43.3%
Total	30	100.0%

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Figure 1.1 Patient preoperatively with infected tibia fracture

Figure 1.2 preoperative X ray of same patient

Figure 1.3 post operative X ray with cemented nail

Figure 2.1 child with infected proximal tibia fracture treated by external fixator and antibiotic cement beads

Figure 2.2 heaing wound with antibiotic beads in situ

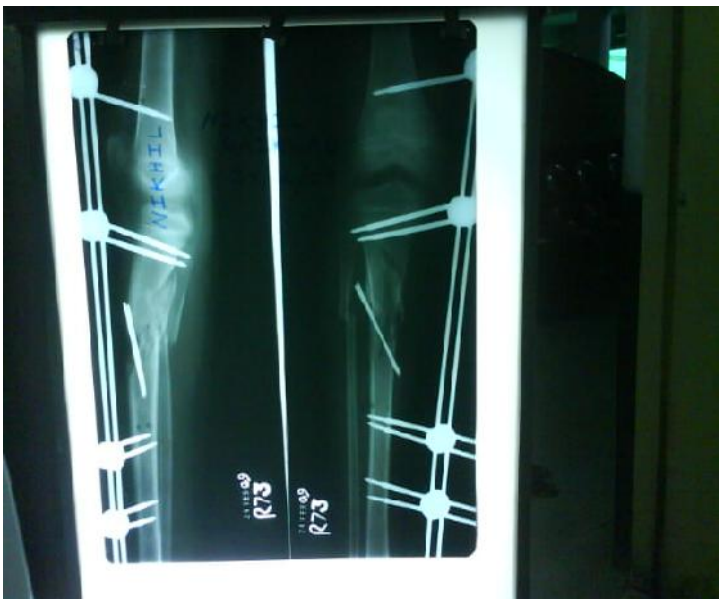

Figure 2.3 X ray of the same child with healing bone

Figure 2.4 After beads removal, healed wound of the same child

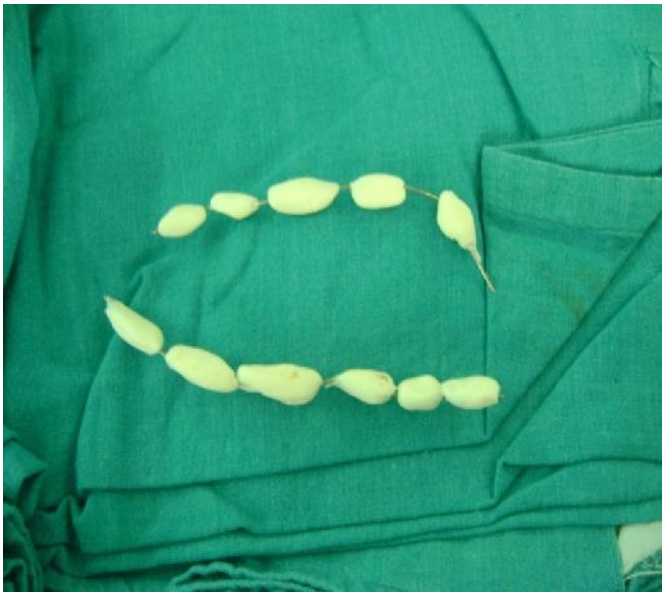

Figure 3.1 antibiotic cement beads prepared for insertion in a patient with infetion around hip, femur nail entry

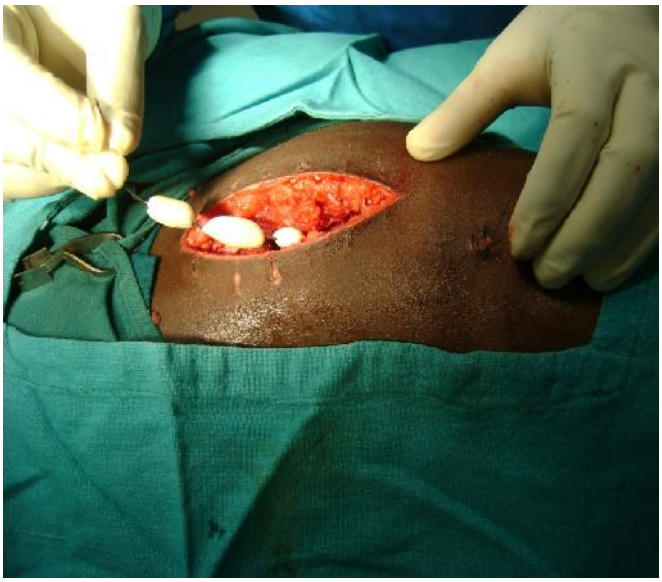

Figure 3.2 same beads being inserted after giving wound wash

Figure 3.3 Antibiotic cement beads inside the wound

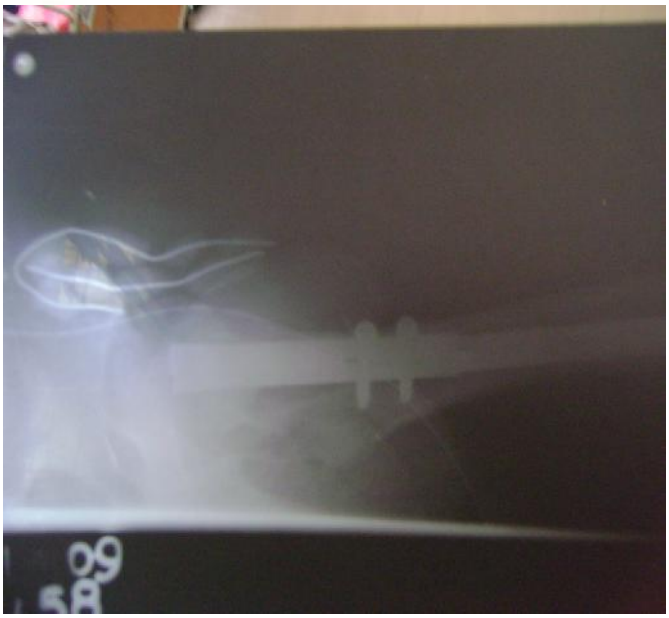

Figure 3.4 X ray of the same patient with antibiotic cement beads in situ

Figure 3.5 Healed wounds of the same patient after infection control and beads removal

DISCUSSION

This is a case series study, so to give comparisons with other modalities of treatment becomes difficult. We will need proper randomized control trials for that. However the results in our study

are comparable to those found by Shyam AK et al.[13] . This procedure definitely avoids many surgeries required for control of infection and wound cover in properly selected patients with less bone defect.

The drawbacks / complications of the procedure are that still in many cases we could not achieve complete infection control, wounds were still present in about 43% patients at last follow-up. There is almost always a need for another implant for definitive fracture fixation, and maybe a bone graft. The patients do not come for removal of implants after infection control and then removal becomes difficult so much so that sometimes they are better left implanted. The antibiotic is sometimes not according to the culture report. About 57% patients had adjacent joint stiffness leading to difficulty in activities of daily living. This stiffness can be attributed to the extensive fibrosis which occurs around the cement beads resulting in loss of joint movements. In a study by Hornyak et al, using only implantable biodegradable allograft and polymers, a sustained release of antibiotics was achieved with ciprofloxacin and vancomycin for several weeks.[14] This would possibly in near future be a better alternative where another surgery for removal can be avoided. Furthermore, if antibiotic impregnated cement fails then Illizarow's ring fixator remains the only option to prevent eventual amputation.

CONCLUSION

Antibiotic impregnated cement bead/nail is a good, simple and inexpensive treatment alternative in the armamentarium of surgeons to control orthopedic infections, especially if there is not much bone loss. The treatment modality should vary as per the requirements. The cement can be left inside the body if it is not producing any foreign body reaction or obstructing any movement. Even after removal of cemented bead/nail adjacent joint stiffness is one of the biggest problems encountered which may be due to fibrosis.

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