

# Persistent infection associated with residual cement after resection arthroplasty of the hip

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Submitted 03-03-18. Accepted 03-12-01

**Background** The danger of residual bone cement after resection of infected prosthetic components is controversial.

**Patients and methods** We analyzed 10 patients with infected total hip prosthesis who had been treated previously with resection arthroplasty and antibiotics and who had persistent infection with residual cement. In 9 patients, surgical debridement with resection of all the PMMA was performed, and adequate intravenous antibiotics were administered. 1 patient refused surgical treatment, but accepted antibiotics.

**Results** At an average of 4 (1–18) years of follow-up, 8 patients had no signs or symptoms of recurrent infection. 1 severely immunodeficient patient died 2 years after the removal of residual cement, for reasons other than his hip. The patient who refused surgical treatment continues to have an active sinus 4 years after first consultation.

**Interpretation** Residual cement may be responsible for chronic infection. At resection arthroplasty, as part of the treatment of an infected hip arthroplasty, all devitalized or foreign material must be removed.

Maximum effort should be made during surgical debridement of an infected hip arthroplasty to remove all implants and cement, as well as devitalized and necrotic tissue. However, this process is sometimes technically demanding, with the risk of bone stock deficiency.

The danger of residual unremoved polymethylmethacrylate (PMMA) after resection of infected prosthetic components is controversial. Some authors (Salvati et al. 1982, Fitzgerald and Jones 1985, McDonald et al. 1989) have put forward

evidence that residual cement may be associated with persistent infection. Some authors (Ahlgren et al. 1980, Petty and Goldsmith 1980, Lieberman et al. 1994) are of the opinion that the presence of residual PMMA does not influence the outcome of the infection after revision.

We analyzed 10 patients with infected hip arthroplasty who had been treated previously with resection arthroplasty and antibiotic treatment, and continued to have persistent infection with residual cement.

## Patients and methods

Between 1984 and 2000, 10 patients (9 men) were followed up at our center, having been treated for septic loosening of a cemented total hip prosthesis with resection arthroplasty and antibiotic therapy, and still undergoing persistent infection. Their radiographs revealed residual cement. The mean age at the time of first revision was 65 (43–79) years. Primary diagnosis was osteoarthritis in 7 patients, osteonecrosis in 2 and femoral neck fracture in 1 patient. All patients had had at least one surgical intervention (range 1–8) as part of the treatment for infection, and had received antibiotic therapy before starting on treatment at our center. 9 of the 10 primary surgeries and removal of components had been performed at another clinic. All but 1 patient had local pain, and 9 of them had an active sinus.

Our treatment protocol consisted of thorough resection of all PMMA, and also of granulation, infected synovial tissue and necrotic tissue. Post-operative intravenous antibiotic therapy was given according to the pathogen and its respective sensi-

Data on patients with chronic infection after removal of THR prosthesis

A	B	C	D	E	F	G	H	I	J	K
1	69	M	OA	24	1	2	17	<i>Proteus mirabilis</i>	I	S
2	70	M	OA	1	1	1	28	MRSA + <i>Escherichia coli</i>	V+Ci	S
3	63	M	OA	12	1	5	7	MRSA + <i>Klebsiella</i> + Group D beta-hemolytic <i>Streptococcus</i>	V+R	Severe RA, death
4	79	M	OA	1	1	1	84	MRSA	V	S
5	53	M	AVN	36	1	7	36	MSSA + <i>Pseudomonas aeruginosa</i>	Ce+A	S
6	43	M	AVN	32	1	1	48	MRSA	V+R	Refused surgery, active sinus
7	68	F	OA	2	1	2	12	MRSA	V	S
8	74	M	Fx	1	1	1	15	MRSA + <i>Proteus mirabilis</i>	V+I	S
9	63	M	AVN	1	1	3	10	<i>Proteus vulgaris</i>	I	S
10	30	M	OA	1	1	2	65	MSSA	Ce	S

  

A Case	J I.v. antibiotics
B Age	A Amykacin
C Sex	I Imipenem
D Primary diagnosis	Ce Cephalotine
AVN avascular necrosis	Ci Ciprofloxacin
Fx femoral neck fracture	R Rifampicin
OA osteoarthritis	V Vancomycin
E Onset of infection	K Outcome
F Previous revisions	S Success
G Additional surgical debridements	RA Rheumatoid arthritis
H Time from onset of infection to index revision	
I Pathogen	
MRSA Methicillin-resistant <i>Staphylococcus aureus</i>	
MSSA Methicillin-sensitive <i>Staphylococcus aureus</i>	

tivity. Intraoperative frozen sections and cultures were positive for infection in all patients. 4 patients were infected with more than one pathogen, and 6 were infected with only one (Table).

One of the patients (case 1) had been treated by removal of components with incomplete resection of PMMA, and 2 months of intravenous gentamicin. He had a painless hip and no sinus formation. After debridement and resection of residual cement, bacteriological examination revealed a multiresistant *Proteus mirabilis* infection which was treated with imipenem.

The patients received oral antibiotic therapy after completion of a protocol of intravenous antibiotic therapy according to the aggressiveness and resistance of the pathogen. 1 patient refused surgical treatment and only accepted suppressive antibiotic therapy.

Success in treatment was defined by the absence of pain or active sinus, normal erythrocyte sedimentation rate and no radiographic evidence of infection at least 1 year after the removal of cement.

## Results

At an average of 4 (1-17) years, 8 patients presented no signs or symptoms of recurrent infection and had a normal erythrocyte sedimentation rate. Pain, active sinus and radiographic signs of active infection persisted in 2 patients. One of these patients suffered from rheumatoid arthritis with severe multisystemic involvement, and died 2 years after the removal of cement for reasons other than the hip infection. The patient who declined surgical treatment presented with persistent active fistula 43 months after the first consultation at our center.

## Discussion

Residual cement after removal of an infected THR can be responsible for persistent infection. 8 of the 10 patients in this study showed no clinical or radiographic signs of infection after an average of 4 years, once the PMMA had been removed. The



Figure. Anteroposterior left hip radiograph of a 68 year-old female patient (case 5) with an infected hip arthroplasty who had been treated previously with resection arthroplasty and antibiotics. She presented with persistent infection, discharging sinus and residual cement.

patient who presented with persistent infection after debridement and removal of cement had severe systemic defects and was immunocompromised. The only patient to refuse surgery for residual cement had persistent clinical signs of active infection. Our findings confirm those of other authors (Salvati et al. 1982, Fitzgerald and Jones 1985, McDonald et al. 1989).

One of the basic principles in the treatment of any infection is to reduce the inoculation of bacteria to a minimum. Biofilms found on the surfaces of some implant materials (Gristina and Costerton 1985, Donlan and Costerton 2002, Dunne 2002) may be responsible for the persistence of infection, and may have been responsible for bacterial resistance due to prolonged antibiotic therapy.

A resection arthroplasty due to infection with residual cement should be considered to be insuffi-

ciently treated and possibly infected. We suggest that intraoperative frozen section tests would be a way of ruling out the presence of infection. Although the reliability of this method in detecting persistent infection is poor, a negative finding has a 98% predictive value (Della Valle et al. 1999). The lack of active sinus does not imply absence of sepsis, as only 30% of infected arthroplasties present with this clinical sign (Raut et al. 1994). Although all but one patient in this study had pain, a painless hip should not be considered to be free of infection in a non-weight-bearing cement.

No competing interests declared.

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