

Is there really allergy to the cement in hip and knee arthroplasty?

Is there evidence of bone cement allergy in arthroplasty?

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Arthroplasties Prothétiques et Douleurs Inexpliquées

Du 16 au 20 janvier 2010 Arc 1800 - Bourg St Maurice

Several Reactions are described after Arthroplasty Implantation with Bone Cement

- ▶ Formation of fistulas,
- ▶ Granuloma formation,
- ▶ Eczema,
- ▶ Hypotension,
- ▶ Hypoxaemia,
- ▶ Cardiac arrhythmias,
- ▶ Cardiac arrest
- ▶ Inflammations,
- ▶ or even implant loosening

Reactions can be divided into 4 categories

- ▶ “Bone Cement Implantation Syndrome”
- ▶ Allergic reactions against bone cement components
- ▶ Inflammatory reactions based on bone cement particles
- ▶ Hypersensitivity against metal ions

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“Bone Cement Implantation Syndrome”

known to be related to the

- ▶ type of cementing technique employed,
- ▶ the extent of the pre-operative patient preparation,
- ▶ and the specific co-morbidities related to the patient,

 and therefore not regarded as a material reaction

“Bone Cement Implantation Syndrome”

Symptoms *intra-operative*

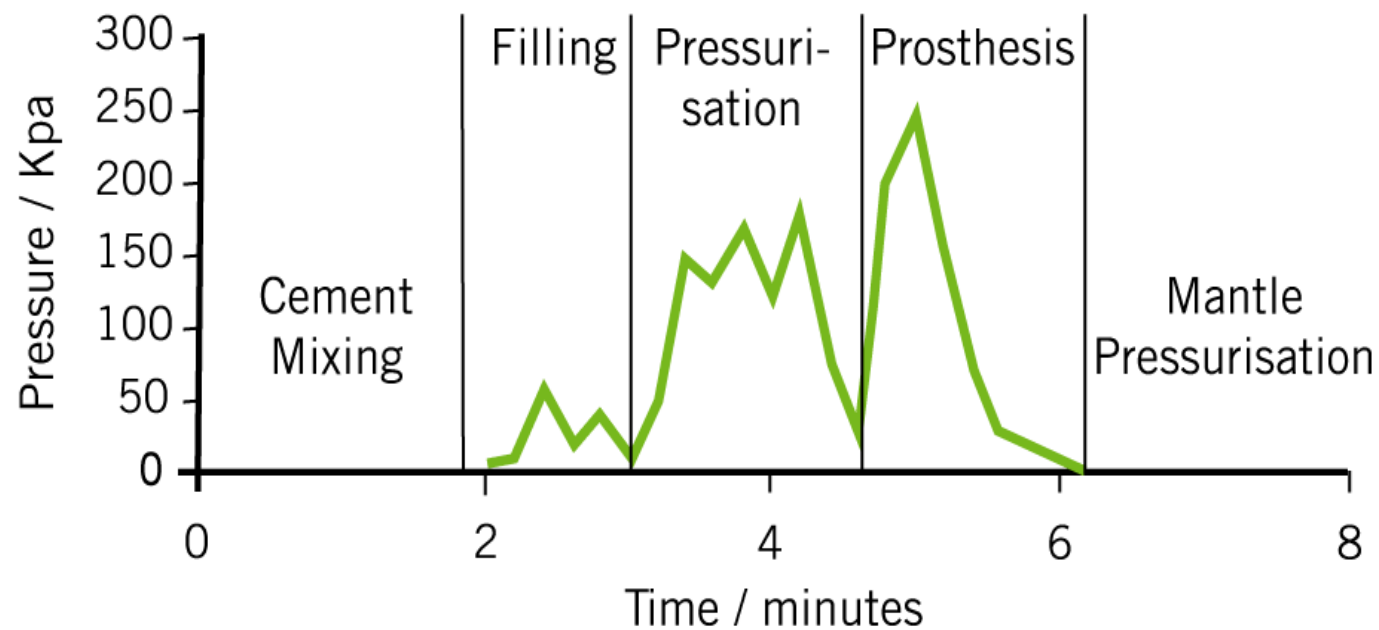
- ▶ hypoxia,
- ▶ increased pulmonary artery (PA) pressures,
- ▶ decreased systemic arterial pressures,
- ▶ rarely cardiac arrest at the time of insertion of cemented
- ▶ during preparation and insertion of femoral prosthesis in THA

Symptoms *post-operative*

- ▶ respiratory and hemodynamic complications,
- ▶ confusion, and coagulopathies

“Bone Cement Implantation Syndrome”

Schematic pressure profile for a total hip implant



Source: McCaskie, A.: Femoral Pressurisation, S.160–163, in: Breusch S J, Malchau [Eds]: The well-cemented Total Hip Arthroplasty, Springer 2000

The risk for fat embolism is reduced by jet lavage

- ▶ The amount of fat, bone marrow and blood clots passed into the venous draining system of the femur is significantly reduced by using a pulsed jet lavage cleaning system



fat in supernatant

Comparison of blood from the iliac veins collected during and after simultaneous cementation of both sheep femora. **Left:** femoral canal cleaned with jet lavage, **Right:** femur canal cleaned with a syringe with identical washing volume



Fig. 15.11. Visible fat extrusion at the anterior aspect of the proximal femur during implantation of the femoral prosthesis

Source: Breusch et al. Pulsatile lavage reduces the risk of fat embolism in cemented THA, Orthopädie 29; 578-586 (2000)

“Bone Cement Implantation Syndrome”

Treatment / Prevention

- ▶ Bone bed preparation by using lavage-systems,
- ▶ Choice of appropriate cement viscosity for application,
- ▶ Retrograde application of cement,
- ▶ Careful pressurization,
- ▶ Slow insertion of implant

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The Composition of Bone cement

	Powder	Liquid
Basis	PMMA Homo- or Heterocopolymers MA, Sty, etc.	MMA
Stabilisor	None	Hydroquinone
Activator / initiator	Benzoyl peroxide	Dimethyl-p-Toluidine
X-ray opacifier	Zirconium dioxide or Barium sulphate	None
Visualiser	E.g. chlorophyll	E.g. chlorophyll
Antibiotics	Gentamicin, Tobramycin, Clindamicin, Vancomycin, Cholistin, Erythromycin	No admixture

Allergic reactions against bone cement components

- ▶ Hand exczema of an acrylate hypersensitive dentist



Allergic reactions against bone cement components

- ▶ Contact dermal exczema and fistula formation based on gentamicin, MMA and Ni/Cr – contact allergy



Thomas et al, Knochenzementallergie, Orthopäde 2006, 35, 956-960

Allergic reactions against bone cement components

Rarely described and reported (feedback) are Typ-IV-
Sensibilisation based on:

- ▶ Acrylates (Mono- , Oligo- and Polymer)
- ▶ BPO
- ▶ N,N-DMpT
- ▶ HQ
- ▶ Antibiotics

Allergic reactions against bone cement components

Symptoms:

- ▶ Formation of fistulas,
- ▶ Granuloma formation,
- ▶ Eczema,
- ▶ Urticarias

Allergic reactions against bone cement components

Prevention:

- ▶ Allergological diagnostics
 - ▶ Medical history or anamnesis regarding known metal or alloy sensitivities
 - ▶ Medical history regarding intolerances against dental materials
 - ▶ Epicutaneous skin test

Epicutaneous tests – table of allergens

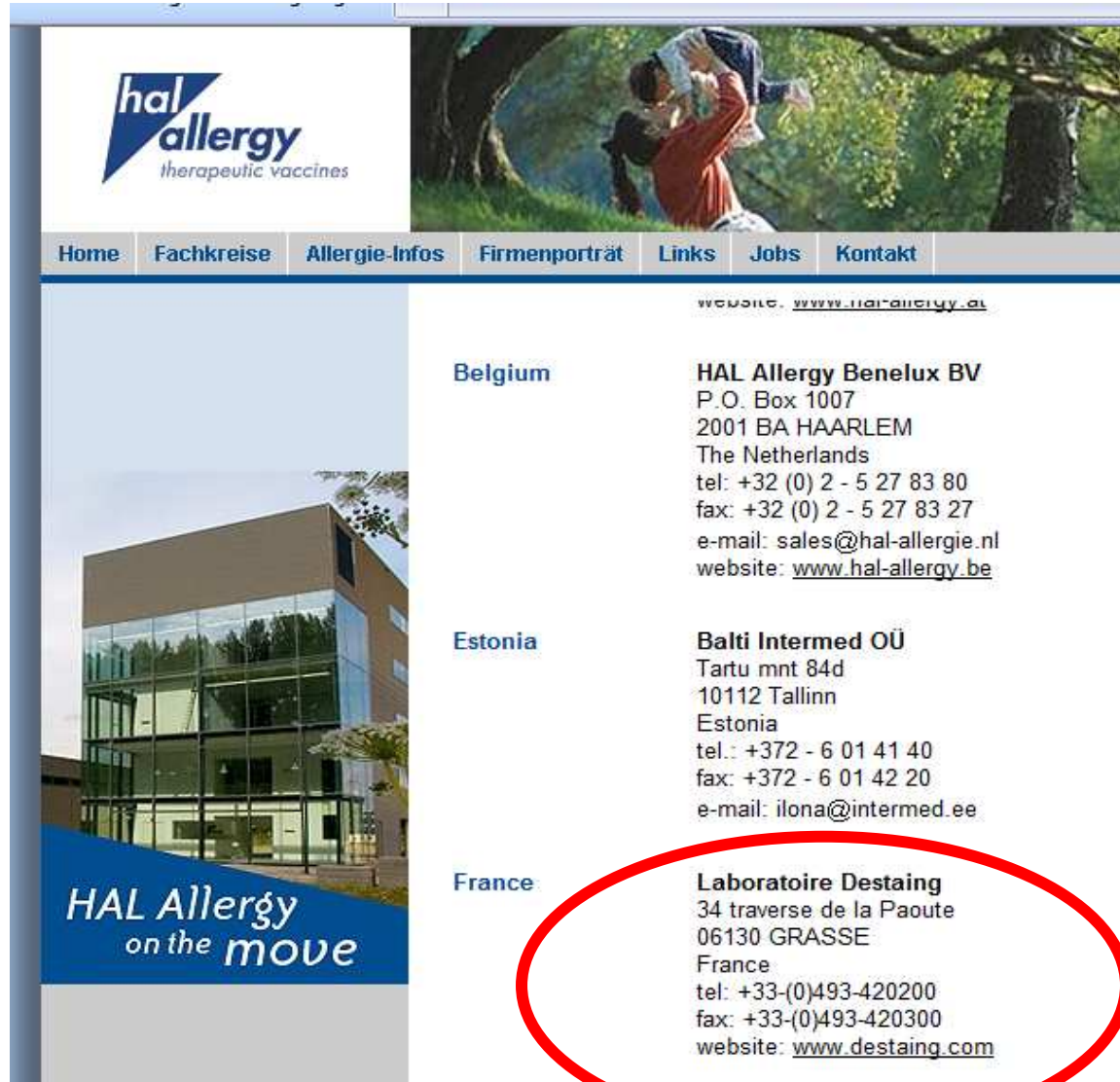
Nr.	Tests	Conz. in %	Vehicle
B 0101	Benzoylperoxide - BPO	1	Vaseline
B 0304	Hydrochinone - HQ	1	Vaseline
B 0326	N,N'-Dimethyl-p-Toluidine	2	Vaseline
B 2308	Methyl-Methacrylate	2	Vaseline
C 1104	Gentamicin sulphate	20	Vaseline
E 1019	Zirconium oxide	0,1	Vaseline

Allergy test –

HAL Allergy

Laboratoire
Destaing

www.destaing.com



hal allergy
therapeutic vaccines

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HAL Allergy
on the move

Allergic reactions against bone cement components

Anaphylactic reaction:

Grade	Skin	Abdomen	Respiratory tract	Cardiac/circulation
I	<ul style="list-style-type: none"> • Itch • Flush • Urticaria • Angioedema 	-	-	-
II	<ul style="list-style-type: none"> • Itch • Flush • Urticaria • Angioedema not oblig. 	<ul style="list-style-type: none"> • Nausea • Cramps 	<ul style="list-style-type: none"> • Rhinorrhea • Hoarse voice • Dyspnoea • Arrhythmia 	<ul style="list-style-type: none"> • Tachycardia (Increase ≥ 20/min) • Hypotonia (Decrease ≥ 20 mmHg systolic)
III	<ul style="list-style-type: none"> • Itch • Flush • Urticaria • Angioedema not oblig. 	<ul style="list-style-type: none"> • Vomiting • Defecation 	<ul style="list-style-type: none"> • Larynxedema • Bronchospasm • Cyanosis 	<ul style="list-style-type: none"> • Shock
IV	<ul style="list-style-type: none"> • Itch • Flush • Urticaria • Angioedema not oblig. 	<ul style="list-style-type: none"> • Vomiting • Defecation 	<ul style="list-style-type: none"> • Breathing arrest 	<ul style="list-style-type: none"> • Cardiac arrest

Classification according to the most severe symptom

Allergic reactions against bone cement components

Treatment - general recommendations:

- Termination of application of suspected agent
- Suitable positioning of patient
- Oxygen supplementation
- Intubation
- Cardio-Pulmonary Resuscitation
- Emergency set of drugs at hand

Allergic reactions against bone cement components

Treatment:

- Cathecholamines (e.g. adrenaline intravenous or intramuscular) alternatively dopamine, noradrenaline or combination with vasopressant
- Volume substitution (e.g. electrolyte solutions, HES)
- Antihistamines
 - H1 blockers e.g. Cetirizine, Loratadine, Terfenadine
Desloratadine, Fexofenadine and Levocetirizine
 - H2 blockers e.g. Ranitidine, Cimetidine
- Glucocorticoids

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Bone Cement Particles

Symptoms / Reactions

- ▶ Inflammation of surrounding soft tissue
- ▶ Granuloma formation
- ▶ Inhibition of osteoprogenitor cells
- ▶ Radio-opacifiers are suspected to increase osteolysis

Bone Cement Particles

Prevention / Treatment

- ▶ Avoiding abrasive bone cement wear
- ▶ Avoiding bone cement – bone cement interface
- ▶ Careful removal of bone cement debris during revision surgery
- ▶ Retrograde application of cement,
- ▶ Careful pressurization

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Hypersensitivity against metal ions

- ▶ Will be discussed in the next presentation

Is there really allergy to the cement in hip and knee arthroplasty?

- ▶ YES
- ▶ Intra-operative reactions (*Hypotension, Hypoxaemia, Cardiac arrhythmias, Cardiac arrest*) are mostly not caused by allergic immune mechanism
- ▶ Rarely reported cases of hypersensitive patients due to bone cement

Is there really allergy to the cement in hip and knee arthroplasty?

In case of suspected allergy against bone cement components an epicutaneous skin test is advised.

If positive - the usage of a material without potentially allergic components should be chosen.