Influence of sodium bicarbonate pre-treatment on final cleaning performance in a washer-disinfector

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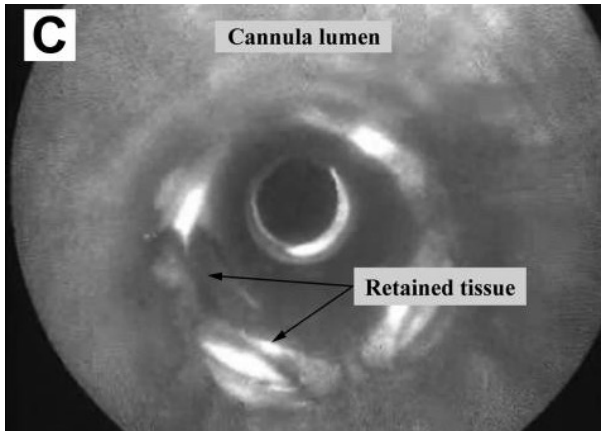
Introduction

Persistence of organic soils on RMD:

- Proliferation of microorganisms within biofilm
- Chemical risk
- Prions

➡ Iatrogenic event for the patient



Outbreak of *Pseudomonas aeruginosa* Surgical Site Infections after Arthroscopic Procedures: Texas, 2009. Pritish K. Tosh, et al

Cleaning performance:

- < 3 µg / cm2 (NF EN ISO 15883-5)
- < 5µg per instrument side (HTM – 0101)

What about pre-treatment ?

France :

- Immediatly after use
- Preventing drying of soils and protection of the personnel
- RMD immersed in detergent-disinfectant solution

Other countries :

- No pre-treatment
- Moist environnement maintened (recommandation) or not
- Sealed pouches, contenairs for transport
- Dry transportation (Germany- Belgium)
- Drying time should be under 6 hours (AKI –working group instrument)

What about 6-hour rule ?

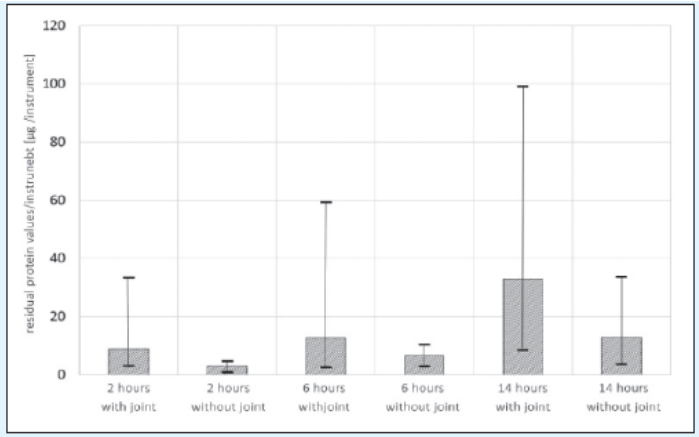


Figure 1a: Mean residual protein values after dwell times of 2, 6 and 14 hours including dry transportation

« This highlihts the negative impact of a longer storage time on the cleaning of instruments »

Michels et al. The influence of the dwell times including transportation on the cleaning of surgical instruments in the WD. Zentral Steril 2022.

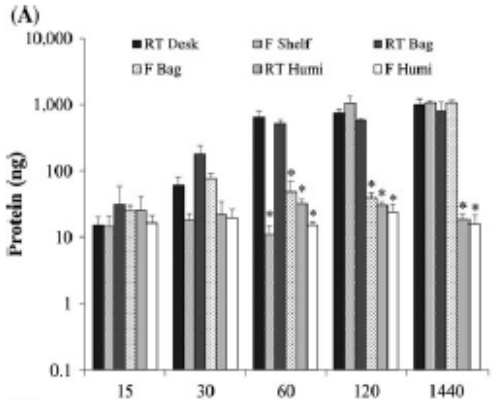
Dry or wet transportation?

« The amount of protein absorbed to the instruments reaches a maximum after 40 min. »

Lipscomb et al. Effect of drying time ambient temperature and pre-soaks on prion-infected tissue contamination levels on surgical stainless steel. JHI 2007.

« Increasing drying times greatly affected protein adsorption »

Secker et al. Efficacy of humidity retention bags for the reduced absoprtion and improved cleaning of tissue proteins including prion assioted amyloid to sugical stainless steel surfaces. Biofouling 2015.



RT : Room temperature (desk or bag)
F : refrigerated air (5 to 7° C)
Humi : sealed within humidity retention pouch

Dry : increase from 15 min to 24h (15.3 +/-4,8 to 1,000 +/- 205 ng)
Refrigerated : increase after 120 min (1,053 +/- 255 ng)
Dry bag : increase after 60 min
Refrigerated dry bag : same level dry conditions after 24h
Humi : no significant increase

1st conclusions

For your CSSD …

Buy a new refrigerator …

… keep your bags !

2nd conclusions

- Instruments **should not be dryed** after use and before reprocessing
- Instruments should be washed immediatly after use
- Reprocessing of SI should take place as soon as possible after surgical procedures

What can we do ?

Detergent-disinfectant solutions:

- Foaming problems ?
- Corrosion ?
- Larges volumes of water
- Ecofriendly ?

Foam sprays:

- Foaming problems ?
- Corrosion ?
- Efficiency ?
- Ecofriendly ?

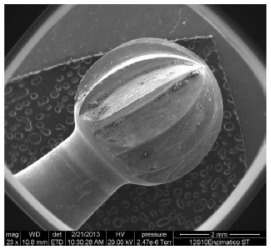
What Else ?

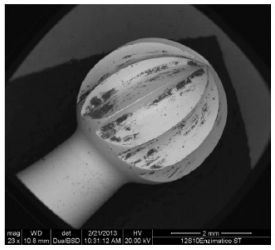
Sodium bicarbonate pre-treatment (BICARmed ®)

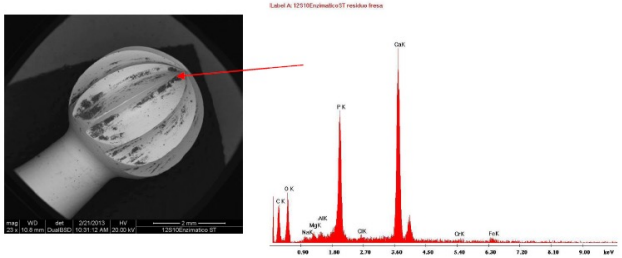
- Safe Clean Box® : pre-treatment equipment
- Close cabin (atmospheric depression) with automatic doors
- Crystalline powder of bicarbonate (Safeclinic ®)
- Pressurized sodium bicarbonate jet (3 bar)
- 2 nozzles : sodium bicarbonate and pressurize water for rinsing

TEST OF THE EFFECTIVENESS OF BICARmed ® TECHNOLOGY TO THE SODIUM BICARBONATE IN THE REMOVAL OF SURFACE CONTAMINATIONS ON DMR'S -

Padova Hospital - Technology Assessment Unit

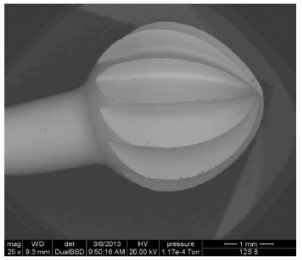


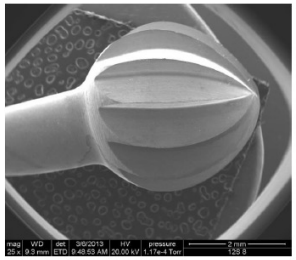


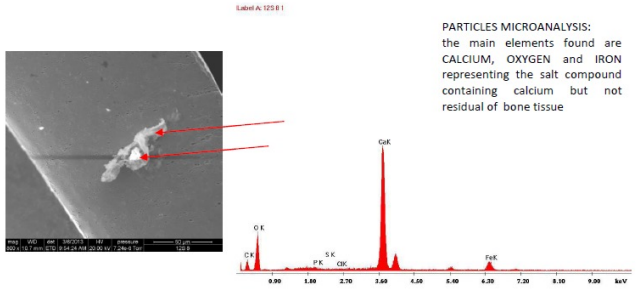


MICROANALYSIS OF DARK PARTICLE: the main elements found are CALCIUM, PHOSPHORUS, OXYGEN (residual bone tissue).

Manuall cleaning- enzymatic detergent
Ultrasounds 5 min., 0,5%, 30°C







BICARmed

Objectives

- Assessment of sodium bicarbonate benefit to facilitate and improve final cleaning of MDR
- Comparison of sodium bicarbonate pre-reatment with immersion in detergent-disinfectant

Material and method

- After use in OR : intruments are randomly divided in 2 arms
  - A : pre-treteament with detergent-disinfectant (Septopredis 0,5%, Dr Weigert)
  - B : pre-treatment with sodium bicarbonate pressurized (BICARmed)
- Cleaning in a washer-disinfector :
  - Belimed WD 290
  - Mediclean advanced® 0,02%, 5 min., 45°C
- Protein detection :
  - Semi-quantitative colorimetric method (Detect®2)
  - Quantitative methode (Proreveal®)

Detect®2

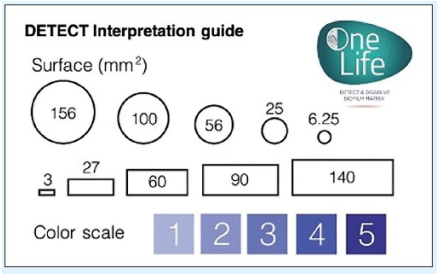
- Protein detection test

Immersion : 5 min

Rinsing

Visual inspection

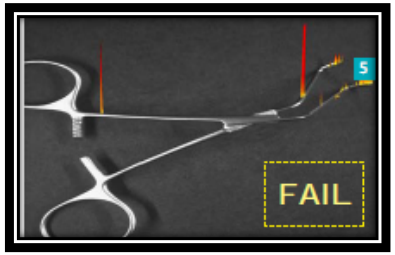
- Interpretation:
  - Intensity of the staining (I.1 to I.5)
  - Surface area (mm^2)
  - Sensitivity 10µg/cm^2



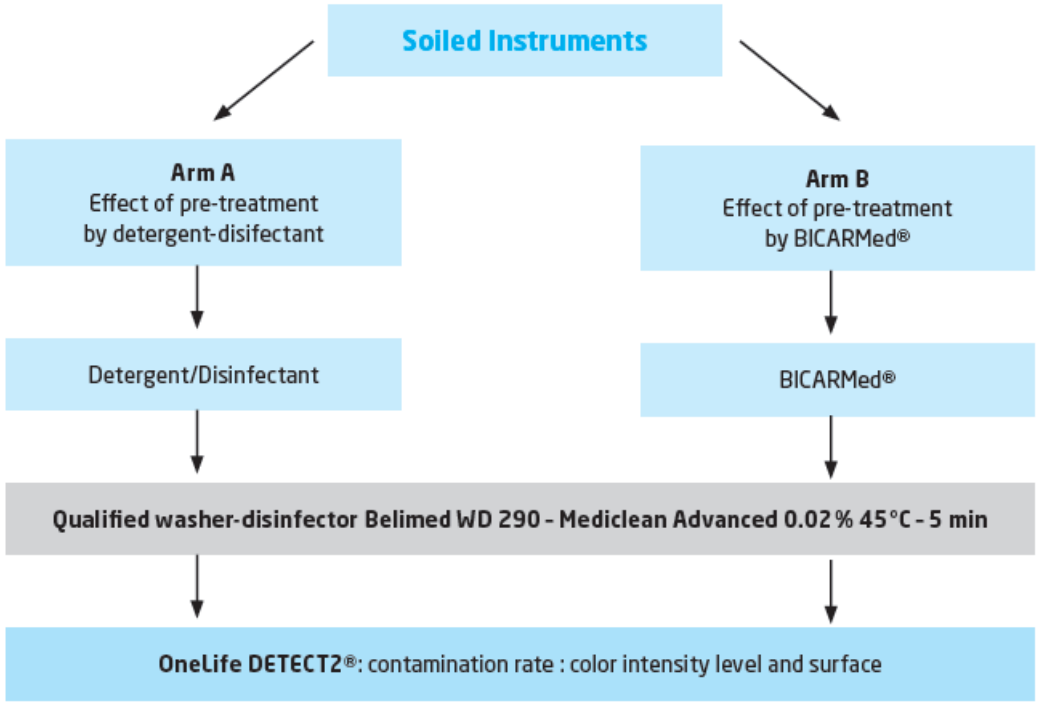
Proreveal®

- Mesure and visualize residual protein after cleaning in WD
- Fluorescent testing method using reagent spray
- Quantitive measurement over the side of the instrument
- Detect down 50ng of residual protein

- Placed the instrument into the Proreveal viewer
- Sprayed with reagent spray
- Close the drawer
- Wait 4 minutes
- Pas or fail result with quantitative remaining proteins



Test protocol



Results :

Arm	Type intervention	Number of instruments	Number of soiled instruments	% of soiled instruments	Average contaminated surface area (mm²)
Arm A: conventional pre-treatment (n=539)	Arthroscopic knee lavage	75	24	32	23,7
	C section	37	21	56,8	44
	AV fistula	45	17	37,8	13
	AV fistula	60	31	51,7	11,9
	Peritoneal catheter placement	32	13	40,6	7,4
	Tympanoplasty	27	11	40,7	13,3
	Cervical conisation	41	21	51,2	6,6
	Aortic endoprosthesis	57	26	45,6	23,1
	Thyroidectomy	34	17	50	9,3
	Pacemaker placement	21	6	28,6	23,4
	Shoulder arthroscopy	23	6	26,1	36
	Abortion	23	10	43,5	32
	Tension-free vaginal tape (TVT)	23	16	69,6	37,8
	Amygdalectomy	27	20	74,1	37
	Arthroscopy	14	2	14,3	4,6

Arm	Type intervention	Number of instruments	Number of soiled instruments	% of soiled instruments	Average contaminated surface area (mm²)
Arm B: BICARMed® pre-treatment (n = 555)	Infant hernia	37	2	5,4	3
	Cholecystectomy	30	6	20	3
	Kyphoplasty	12	2	16,7	3
	Total knee replacement	115	17	14,8	
	Total hip replacement	42	15	35,7	17,5
	Thyroidectomy	46	9	19,6	3,4
	Appendectomy	26	6	23,1	10,9
	C section	30	18	60	27,7
	AV fistula	59	15	25,4	12,2
	Knee arthrodesis	19	2	10,5	3
	Toe arthrodesis	42	2	4,8	14
	Shoulder arthroscopy	20	3	15	25
	Removal of material	24	1	4,2	3
	Placement of implantable port	33	5	15,2	9,4
	Carotid surgery	20	7	35	22,6

Arm A
Soiled instruments : 14 à 74%
Average : **44,7% (241/539)**

Arm B
Soiled instruments : 4 à 60%
Average : **19,8% (110/555)**

p<0,001

Results : soiled surfaces

Arm	Procedure	Number of soiled instruments	Number of soiled instrument with Surface of					
			3 mm² (%)	6,25 mm² (%)	25 mm² (%)	60 mm² (%)	100 mm² (%)	156 mm² (%)
conventional pre-treatment	Arthroscopic knee lavage	24	14 (58,3 %)	0	4 (16,7 %)	4 (16,7 %)	2 (8,3 %)	0
	C section	21	4 (19,0 %)	0	10 (47,6 %)	4 (19,1 %)	1 (4,8 %)	2 (9,5 %)
	AV fistula	17	10 (58,8 %)	4 (23,5 %)	3 (17,6 %)	0	0	0
	AV fistula	31	17 (54,8 %)	2 (6,5 %)	12 (38,7 %)	0	0	0
	Peritoneal catheter placement	13	7 (53,8 %)	4 (30,8 %)	2 (15,4 %)	0	0	0
	Tympanoplasty	11	3 (27,3 %)	5 (45,5 %)	2 (18,2 %)	1 (9,1 %)	0	0
	Cervical conisation	21	9 (42,8 %)	10 (47,6 %)	2 (9,5 %)	0	0	0
	Aortic endoprosthesis	26	9 (34,6 %)	8 (30,8 %)	4 (15,4 %)	3 (11,5 %)	1 (3,8 %)	1 (3,8 %)
	Thyroidectomy	17	7 (41,2 %)	6 (35,3 %)	4 (23,5 %)	0	0	0
	Pacemaker placement	6	1 (16,7 %)	1 (16,7 %)	3 (50 %)	1 (16,7 %)	0	0
	Shoulder arthroscopy	6	2 (33,3 %)	2 (33,3 %)	0	0	2 (33,3 %)	0
	Abortion	10	3 (30 %)	3 (30 %)	1 (10 %)	2 (20 %)	0	1 (10 %)
	Tension-free vaginal tape (TVT)	16	2 (12,5 %)	4 (25 %)	6 (37,5 %)	2 (12,5 %)	0	2 (12,5 %)
	Amygdalectomy	20	2 (10 %)	0	8 (40 %)	8 (40 %)	2 (10 %)	0
	Arthroscopy	2	1 (50 %)	1 (50 %)	0	0	0	0

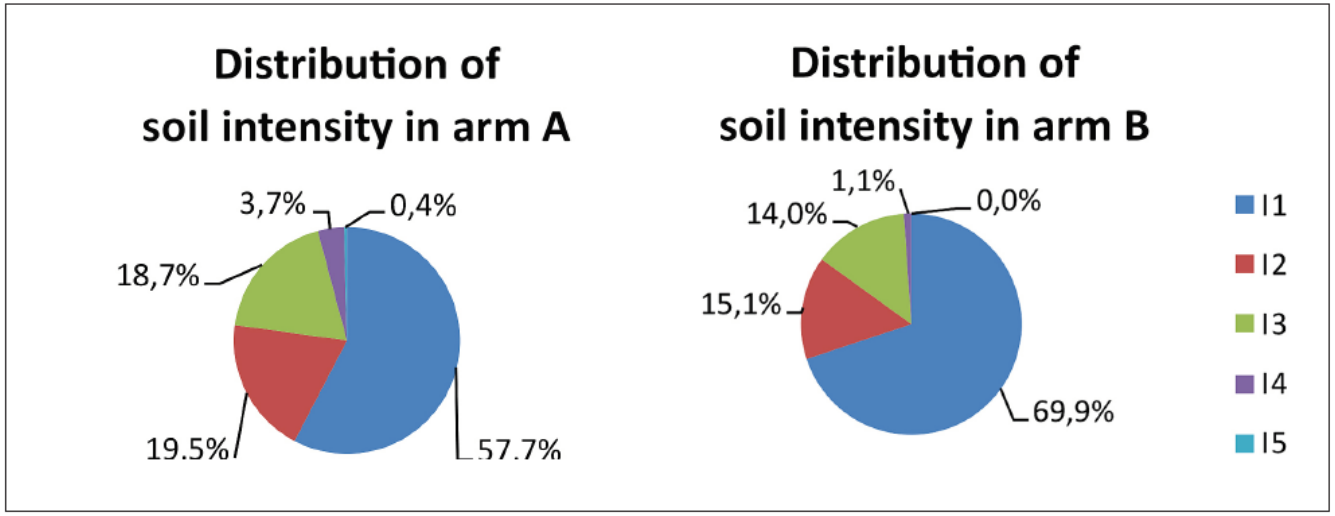
Arm	Procedure	Number of soiled instruments	Number of soiled instrument with Surface of					
			3 mm² (%)	6,25 mm² (%)	25 mm² (%)	60 mm² (%)	100 mm² (%)	156 mm² (%)
BICAR-Med® pre-treatment	Infant hernia	2	2 (100 %)	0	0	0	0	0
	Cholecystectomy	6	6 (100 %)	0	0	0	0	0
	Kyphoplasty	2	2 (100 %)	0	0	0	0	0
	Total hip replacement	15	5 (33,3 %)	2 (13,3 %)	7 (46,7 %)	1 (6,7 %)	0	0
	Thyroidectomy	9	8 (88,9 %)	1 (11,1 %)	0	0	0	0
	Appendectomy	6	3 (50 %)	1 (16,7 %)	2 (33,3 %)	0	0	0
	C section	18	4 (22,2 %)	1 (5,6 %)	8 (44,4 %)	5 (27,8 %)	0	0
	AV fistula	15	5 (33,3 %)	6 (40 %)	3 (20 %)	1 (6,7 %)	0	0
	Knee arthrodesis	2	2 (100 %)	0	0	0	0	0
	Toe arthrodesis	2	1 (50 %)	0	1 (50 %)	0	0	0
	Shoulder arthroscopy	3	0	0	3 (100 %)	0	0	0
	Removal of material	1	1 (100 %)	0	0	0	0	0
	Placement of implantable port	5	1 (20 %)	3 (60 %)	1 (20 %)	0	0	0
	Carotid surgery	7	3 (42,8 %)	2 (28,6 %)	1 (14,3 %)	1 (14,3 %)	0	0

Arm A
Average : **4,6 to 44 mm2**

p<0,0031

Arm B*
Average : **3 to 27,7 mm2**

Results : soil intensity



- Proportion with intensity contamination (I1) are significantly different between two arms (p-value = 0,04)
- Proportion of I2 to I5 is highter in arm A

Results : Proreveal analyse

- Dental extraction set (40 instruments)
- Total protein by instrument (µg)
  - Arm A : 0 to 17,7 µg
  - Arm B : 0 to 9,9 µg

Acceptable level:
- < 3 µg / cm2 (NF EN ISO 15883-5)
- < 5µg per instrument side (HTM – 0101)

	Immersion	BicarMed
Instrument 1	1,5	0
Instrument 2	0	0
Instrument 3	0,8	0
Instrument 4	1	2
Instrument 5	0,5	0
Instrument 6	0,2	0
Instrument 7	1	0
Instrument 8	0	3,6
Instrument 9	4,2	0
Instrument 10	4,9	0,7
Instrument 11	1,4	4,8
Instrument 12	0,4	0
Instrument 13	1,7	9,9
Instrument 14	0,1	0,7
Instrument 15	0	0,3
Instrument 16	2,8	1
Instrument 17	0	0,3
Instrument 18	0	0
Instrument 19	0	0,1
Instrument 20	0	0

	Immersion	BicarMed
Instrument 21	1,3	0
Instrument 22	0,8	0,5
Instrument 23	0	0
Instrument 24	16,8	0
Instrument 25	0	0
Instrument 26	4,9	1,9
Instrument 27	1,5	2,5
Instrument 28	0	0
Instrument 29	0	0
Instrument 30	0	0
Instrument 31	0,2	3,1
Instrument 32	0	3,7
Instrument 33	5,1	2,8
Instrument 34	0	3,7
Instrument 35	5,6	0
Instrument 36	17,7	1
Instrument 37	1,2	1,2
Instrument 38	0,2	3,2
Instrument 39	10,5	0
Instrument 40	0	0

Discussion

- Percentage of instruments soiled seems to be hight in this study :
  - Blue strains are easier to observed
  - Detect ®2 highlight stains not detectable by visual inspection
  - A large quote of stains is < 3 mm^2 and Level 1 intensity (threshold of Detect®)
  - Level under acceptance value < 3µg/ cm 2

- In this study, residual protein level is very low with the two methods comparatively another studies performed in clinical conditions

Discussion

- Dryed soils without pretreatment :
  - Cleaning difficulties on CSSD
  - Excess time for manual cleaning
  - Increase cost retreatment per instrument (Walker Stockert and al. Assessing the magnitude and costs of intraoperative inefficencies attribuable to surgical instruments trays. J Am Coll Surg 2014)

- Surgeries with greater cleaning difficulties : gynaecological, orodental, ENT
  - Large contribution of mucus ?

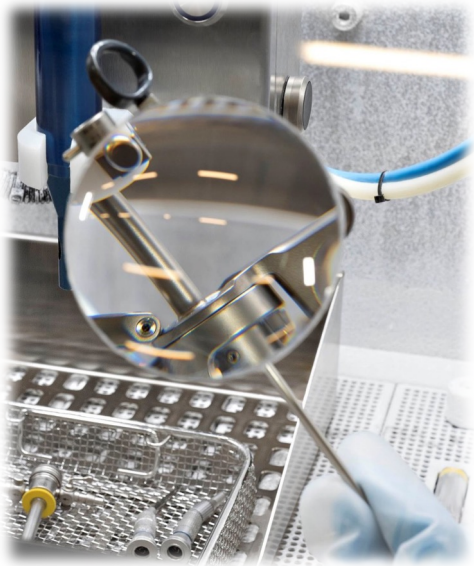
Conclusions

- Superiority of pressurized bicarbonate than immersion in detergent-disinfectant solution
- Should be realized in the OR before transport to CSSD
- Prevent drying and facilitate cleaning in WD
- Less corrosion than using detergent-disinfectant
- Easy to perform

Take Home Message

Pressurized sodium bicarbonate pre-treatment :

- Safe
- Effective
- Ecofriendly



CENTRE HOSPITALIER MÉTROPOLE SAVOIE

Thank you for your attention

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