

Cardioprotective Haemodialysis

The new FX CorDiax

Designed to Dialyse. Built for Cardioprotection



Cardioprotective Haemodialysis **SPOT**

Protect your Patient

Cardioprotective Haemodialysis

The reduction of risk factors for cardiovascular diseases (CVD) is core to the development of dialysis systems and products at Fresenius Medical Care. Outstanding cardioprotection must be reflected in all levels of product development and application.

Wide-ranging cardioprotection

There have been tremendous improvements in the quality and efficacy of haemodialysis (HD) therapy in recent years. Despite this, cardiovascular diseases (CVD) remain the leading cause of death for patients with end-stage renal disease (ESRD).

SFP

Services

Over 30 years experience in dialysis at your service.

- Project planning and consulting
- Training and Education
- Technical Services
- Water Quality Service (WQS)
- Medical Information Services

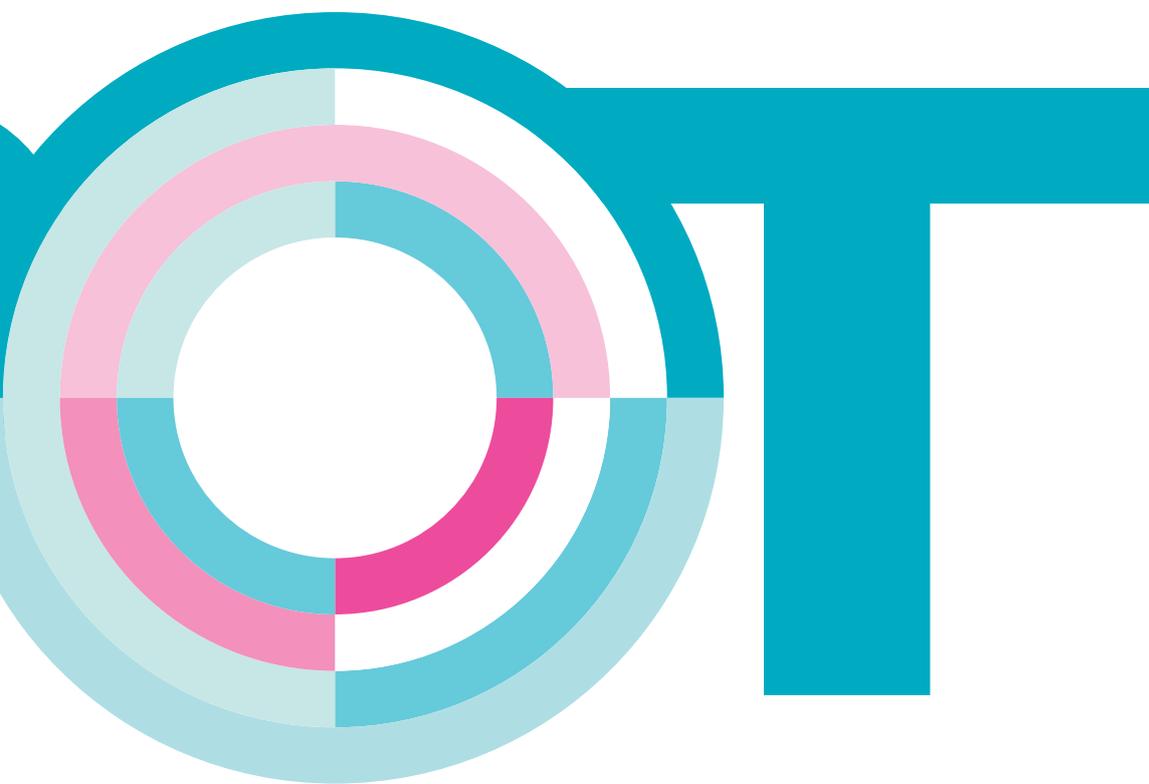
Products

State-of-the-art technologies enable advanced cardioprotective therapies.

- CorDiax Product line:
 - 5008 CorDiax and 5008S CorDiax
 - FX CorDiax dialysers
 - BCM-Body Composition Monitor
- Classix Product line:
 - 4008S classix
 - FX classix dialysers
- Therapy Data Management System (TDMS)
- Online Purification Cascade® (OPC)

Moreover, overall and cardiovascular mortality is markedly greater in ESRD patients than in the general population. This is why we put Cardioprotective HD on the SPOT. A comprehensive approach that includes services, products and therapies

is needed to achieve the best therapeutic performance – meaning improved clinical outcomes and better quality of life, enhanced control of therapy costs, and simpler, safer handling.



Outcomes

Achieving better outcomes with cardioprotective therapies.

- Reduced mortality risk
- Fewer cardiovascular complications
- Optimised use of resources

Therapies

Cardioprotective therapies designed by the world market leader in haemodialysis.

- High-Flux dialysis
- ONLINE HDF
- Advanced Fluid Management

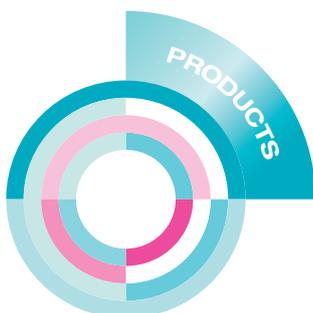
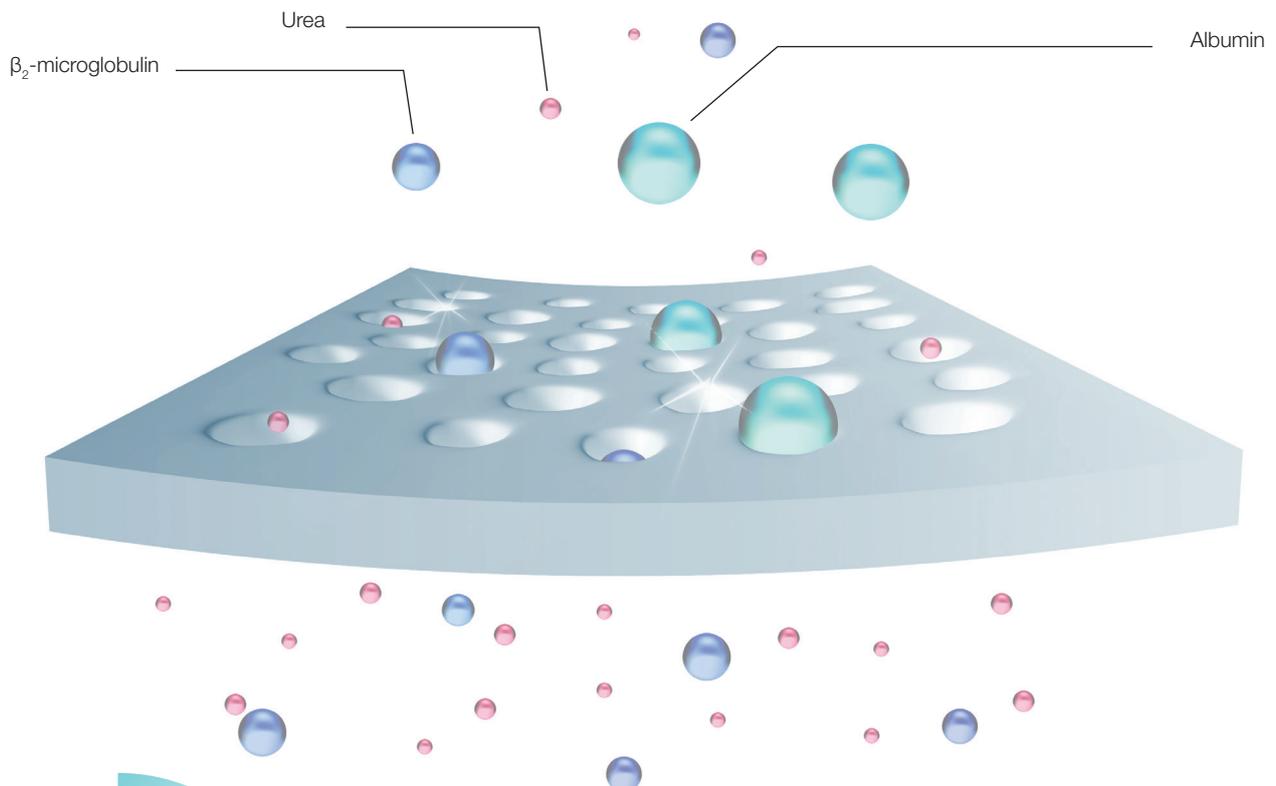
Cardioprotection – at the heart of long-term haemodialysis

The effects of chronic kidney disease (CKD) as well as the effects of dialysis itself can lead to cardiovascular diseases [e.g. atherosclerosis and left ventricular hypertrophy (LVH)], the largest causes of death in haemodialysis patients.¹ Improved middle molecule removal, through enhanced High-Flux membranes for haemodiafiltration, can substantially reduce these risks.²

A number of large, multi-centre studies show that the use of High-Flux membranes improves patient survival and quality of life.³

Middle molecule removal means the selective filtration of a broad range of uremic toxins with a molecular weight higher than 500 Dalton (Da). At the same time, the membrane should prevent the loss of substances known to be associated with patient survival, such as serum albumin. This high sieving potential must be accompanied by excellent biocompatibility.

Innovative membranes such as Helixone® provide enhanced filtration, with high sieving of low molecular weight (LMW) and middle molecular weight (MMW) substances as well as volume exchange, while



reducing the induction of inflammatory cascades that are central to many aspects of CVD.

State-of-the-art technologies such as Fresenius' Nano Controlled Spinning (NCS™) and INLINE steam sterilisation are the result of continual innovation at Fresenius Medical Care.

Advances in material and production technologies have permitted improvements in the wall structure by opening up the support region of the membrane.

The Helixone®*plus* membrane in the new FX CorDiax dialysers improves the clearance of middle molecules while the loss of essential blood components such as albumin is curtailed. The Helixone®*plus* membrane upgrades the FX-class® dialyser into the CorDiax product line, which provides products for superior cardioprotective therapies.

SPOT on:

- CVD are the largest causes of death in dialysis patients.
- High-Flux membranes enhance middle molecule removal and reduce risk factors.
- FX CorDiax for enhanced survival and better outcomes.

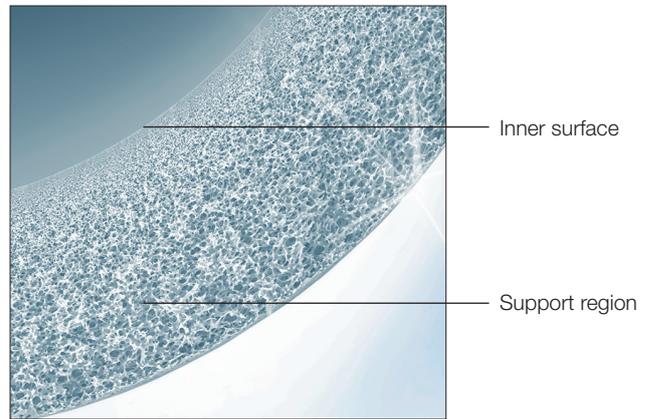


The new FX CorDiax

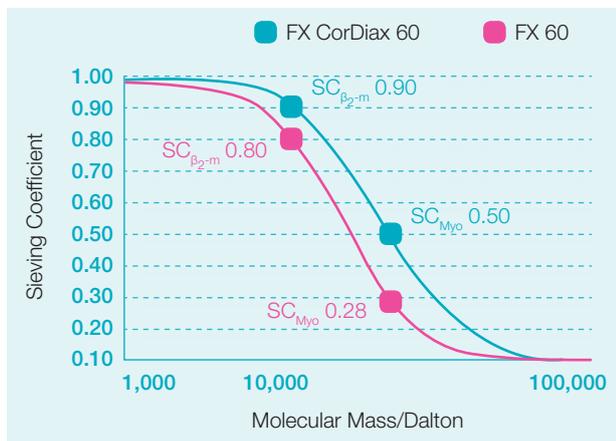
Middle molecules – enhancing survival and better outcome

Advances in fibre design allow better removal of uremic toxins

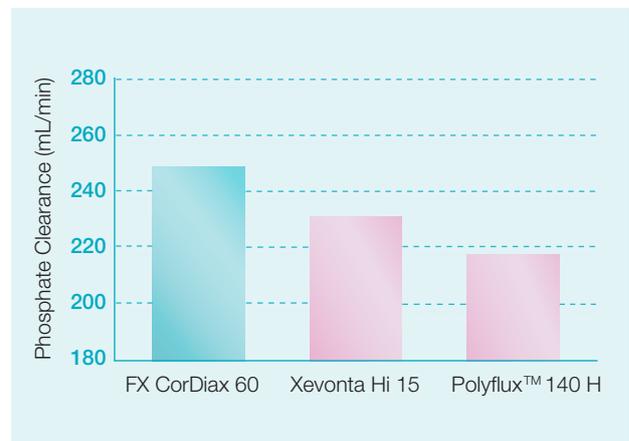
- The fibre support region underneath the inner surface has been »opened up«, optimising porosity and therefore also the convective filtration (»flushing«) of larger uremic toxins such as β_2 -microglobulin ($\approx 11,800$ Da) or myoglobin ($\approx 17,000$ Da).
- At the same time the retention of beneficial molecules such as albumin is improved.
- The reduced transmembrane resistance improves the removal of a broad range of middle molecules as well as of low molecular weight substances, e.g. phosphate.



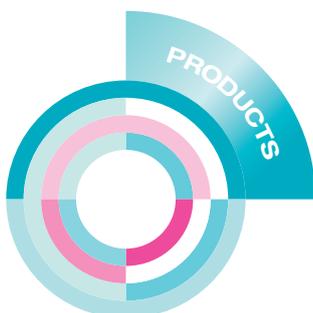
Close-up of the inner surface and the support region of the membrane.



Comparison of sieving coefficient data of FX 60 and FX CorDiax 60.



Comparison of aqueous in-vitro clearances of phosphate ($Q_b = 300$ mL/min, $Q_d = 500$ mL/min). Investigations carried out by EXcorLab GmbH, an Accredited Calibration and Testing Laboratory.



References

- 1 de Jager D. et al., JAMA (2009); 302: 1782-1789.
- 2 Canaud B., Contrib Nephrol (2007); 158: 216-224.

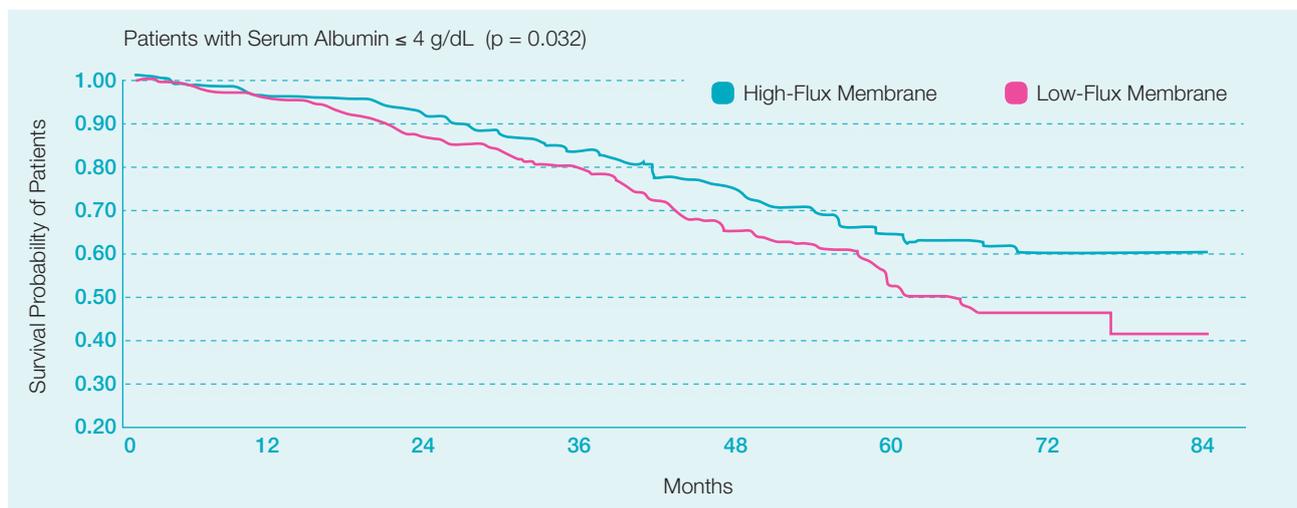
Clearing middle molecules improves survival rates

The use of High-Flux membranes such as FX-class® High-Flux dialysers improves patient survival rates. Additional long-term patient outcomes are also substantially better. This is further enhanced by the INLINE steam sterilisation process that both sterilises the filters and flushes out any residual pyrogens and toxins.

- Patient survival rates are improved.³
- Inflammation markers are reduced.⁴
- EPO doses can be reduced while control of anaemia is maintained.⁵
- Immune dysfunctions may be reversed.⁶

SPOT on:

- Removing middle molecules is linked to reduced inflammation.
- High-Flux dialysers can reduce risk of death in long-term HD.



Kaplan-Meier survival curves for the population of patients with serum albumin levels ≤ 4.0 g/dL (log-rank test $p = 0.032$).³

(Graph adapted from original publication)

3 Locatelli F. et al., Journal of American Society of Nephrology (2009); 20: 645-654.

4 Pedrini L. A. et al., Nephrol Dial Transplant (2011); doi: 10.1093/ndt/gfq761.

5 Bonforte G. et al., Blood Purif (2002); 20: 357-363.

6 Lonnemann G. et al., Blood Purif (2003); 21(3): 225-231.

The new FX CorDiax

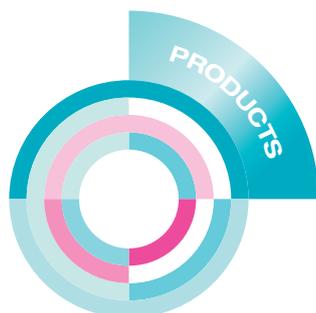
Performance Data

Sieving coefficients of FX CorDiax High-Flux Dialysers and Haemodiafilters	Molecular weight (Dalton)	
Albumin	66,500	< 0.001
Myoglobin	17,053	0.5
β_2 -microglobulin	11,731	0.9
Inulin	5,200	1

Membrane material	Helixone® plus
Sterilisation method	INLINE steam
Housing material	Polypropylene
Potting compound	Polyurethane
Units per box	24

FX CorDiax High-Flux Dialysers		FX CorDiax 40	FX CorDiax 50	FX CorDiax 60	FX CorDiax 80	FX CorDiax 100	FX CorDiax 120
Clearance ($Q_b = 300$ mL/min)							
Cytochrome c	12,230	48 *	76	96	111	125	136
Inulin	5,200	56 *	88	116	127	144	149
Vitamin B ₁₂	1,355	96 *	144	175	190	207	213
Phosphate	132	142 *	215	237	248	258	262
Creatinine	113	155 *	229	252	261	272	274
Urea	60	175 *	255	271	280	283	284
Clearance ($Q_b = 400$ mL/min)							
Cytochrome c	12,230	–	–	100	117	133	145
Inulin	5,200	–	–	122	135	154	160
Vitamin B ₁₂	1,355	–	–	191	209	229	237
Phosphate	132	–	–	270	285	299	305
Creatinine	113	–	–	290	303	321	325
Urea	60	–	–	319	336	341	343
*Clearance ($Q_b = 200$ mL/min)							
Ultrafiltration coeff. (mL/h x mmHg)		21	33	47	64	74	87
<i>In vitro performance: $Q_d = 500$ mL/min, $Q_f = 0$ mL/min, $T = 37^\circ\text{C}$ (EN 1283, ISO 8637). Ultrafiltration coefficients: human blood, Hct 32%, protein content 6%.</i>							
Effective surface (m ²)		0.6	1.0	1.4	1.8	2.2	2.5
K _{oA} Urea		547	886	1,164	1,429	1,545	1,584
Priming volume (mL)		32	53	74	95	116	132
Article number		F00001588	F00001589	F00001590	F00001591	F00001592	F00002384

FX CorDiax Haemodiafilters		FX CorDiax 600	FX CorDiax 800	FX CorDiax 1000
Clearance ($Q_b = 300$ mL/min, $Q_f = 75$ mL/min)				
Cytochrome c	12,230	131	141	151
Inulin	5,200	144	156	166
Vitamin B ₁₂	1,355	204	217	225
Phosphate	132	257	267	271
Creatinine	113	271	277	280
Urea	60	285	291	292
Clearance ($Q_b = 400$ mL/min, $Q_f = 100$ mL/min)				
Cytochrome c	12,230	149	160	172
Inulin	5,200	166	178	190
Vitamin B ₁₂	1,355	235	251	262
Phosphate	132	307	321	328
Creatinine	113	327	339	343
Urea	60	354	365	367
Ultrafiltration coeff. (mL/h x mmHg)		46	62	76
<i>In vitro performance: $Q_d = 500$ mL/min, $T = 37^\circ\text{C}$ (EN 1283, ISO 8637). Ultrafiltration coefficients: human blood, Hct 32%, protein content 6%.</i>				
Effective surface (m ²)		1.6	2.0	2.3
K _{oA} Urea		1,148	1,365	1,421
Priming volume (mL)		95	115	136
Article number		F00001593	F00001594	F00001595



Cardioprotective Haemodialysis

Innovation at all Levels

FX-class® Design

FX-class® Design



Cardioprotective Haemodialysis **SPOT**

Protect your Patient

Superior by Design

Several state-of-the-art technologies have been combined to create the distinctive, functional features of FX-class® dialysers, which are refined and optimised for performance, safety and handling:

- Design of dialyser housing and fibre bundle for more uniform dialysate flow.
- Refined blood inlet port for improved haemodynamics.

Advances in material and production technologies have permitted improvements in the wall structure of the Helixone®*plus* membrane of the FX CorDiax.

- More porous Helixone®*plus* membrane wall for higher clearance of middle molecules.

Optimised dialysate flow

The 3-dimensional microwave structure of the fibre ensures uniform radial dialysate flow around each fibre within the bundle by preventing fluid channelling, thereby further enhancing clearance values and improving the overall performance of the dialyser.

Better haemodynamics

The lateral blood-inlet port ensures more homogenous blood flow in the dialyser header, preventing stagnation zones. The design essentially eliminates the risk of kinking, contributing to improved safety.

Enhanced convection

The more open structure of the Helixone®*plus* membrane support region serves to reduce diffusion resistance and increases convective filtration. This facilitates clearance of a broad range of uremic toxins, especially the middle molecules.

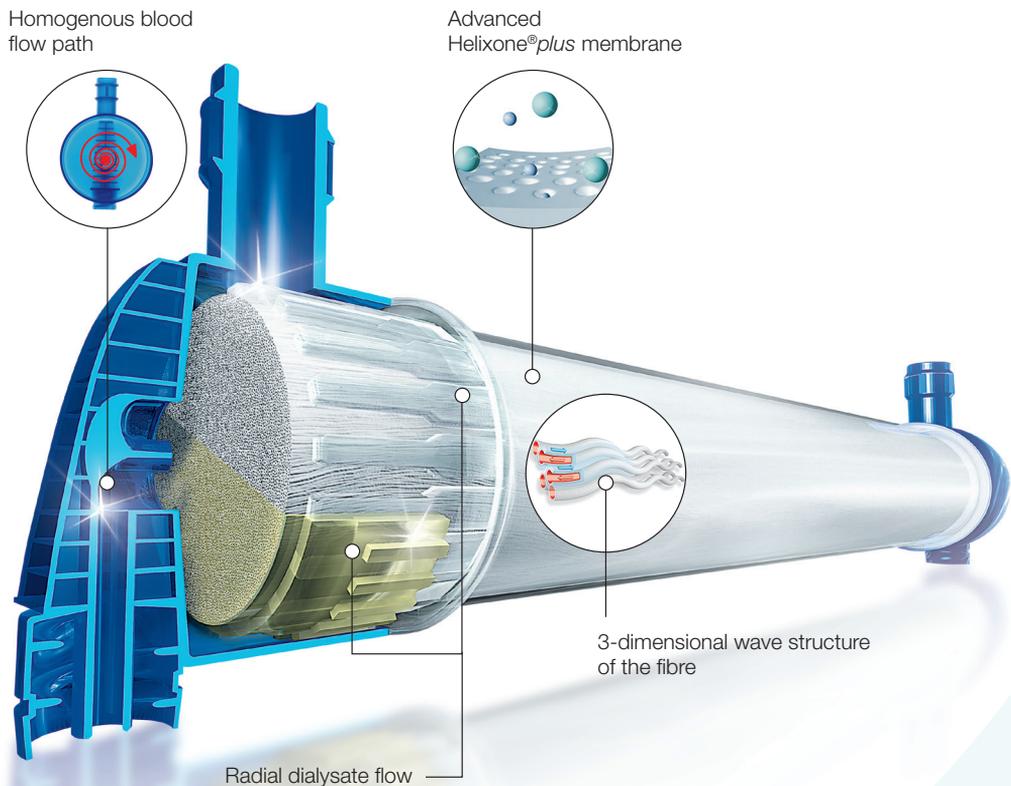


Kind to the environment

Advanced design goes beyond direct functionality, it also has to be easy on the environment. FX-class® dialysers weigh less than half as much as previous dialysers, and at the same time use ecologically friendly plastics. This means a lower carbon-footprint as a result of fewer materials, less packaging, less fuel for transport and cleaner waste management. Due to less priming volume and easy preparation, costs are reduced as well.

SPOT on:

- Optimised performance due to radial dialysate flow.
- Enhanced clearance of middle molecules enabled by a more porous support region of the membrane.



Cardioprotective Haemodialysis

The Pure Difference

INLINE Steam Sterilised Dialysers



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Clean and safe

FX-class® dialysers are sterilised using the unique INLINE steam sterilisation process specifically developed by Fresenius Medical Care.

During the INLINE steam sterilisation process, both the blood and the dialysate compartments are rinsed continuously with steam > 121°C. Since no additional chemicals are needed for cleaning or sterilisation, the finished dialysers have extremely low levels of residuals.

Purity ensured – with steam

No chemical residuals with INLINE steam sterilisation

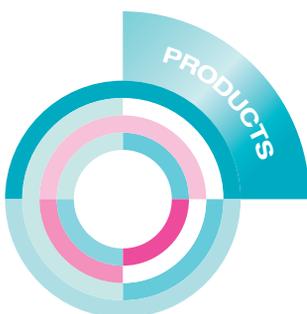
No need for gamma sterilisation – high energy ionising radiation can degrade and alter the material chemistry, producing potential cytotoxic and carcinogenic residuals inside the dialyser.¹

Low rinsing volumes

Minimal preparation time – since dialysers are clean on arrival, rinsing times prior to use are substantially reduced.

Less rinsing – lower costs

Lower rinsing volumes mean reduced preparation times and costs.



References

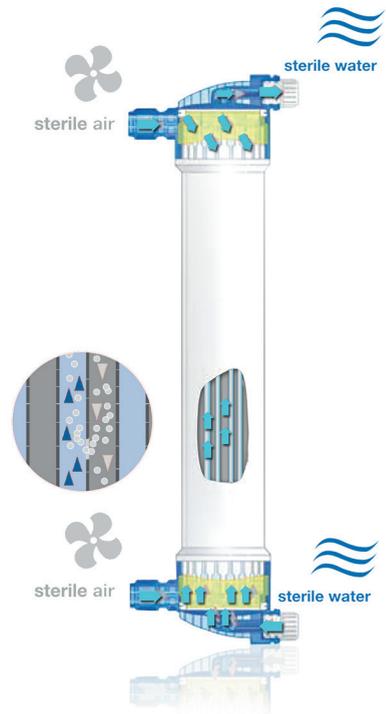
- 1 Shintani H. et al., Journal of Analytical Toxicology (1989); 13: 354-357.
- 2 Müller T. F. et al., Nephron (1998); 78: 139-142.

SPOT on:

- Reduced risk of blood contact with toxic residuals.¹
- Activation of the complement system is reduced.²



Integrity test: Air pressure is applied to the fibre bundle from one side while the other side contains sterile water. If any leakages were present in the membrane, air would pass the membrane and create bubbles.



INLINE steam sterilisation process and integrity test.

Cardioprotective Haemodialysis

Purity by Design

Superior Endotoxin Retention

Superior Endotoxin Retention



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What are endotoxins?

Endotoxins are large molecules from the outer membrane wall of gram-negative bacteria. Chemically, endotoxins are lipopolysaccharides (LPS), having lipid and polysaccharide components.

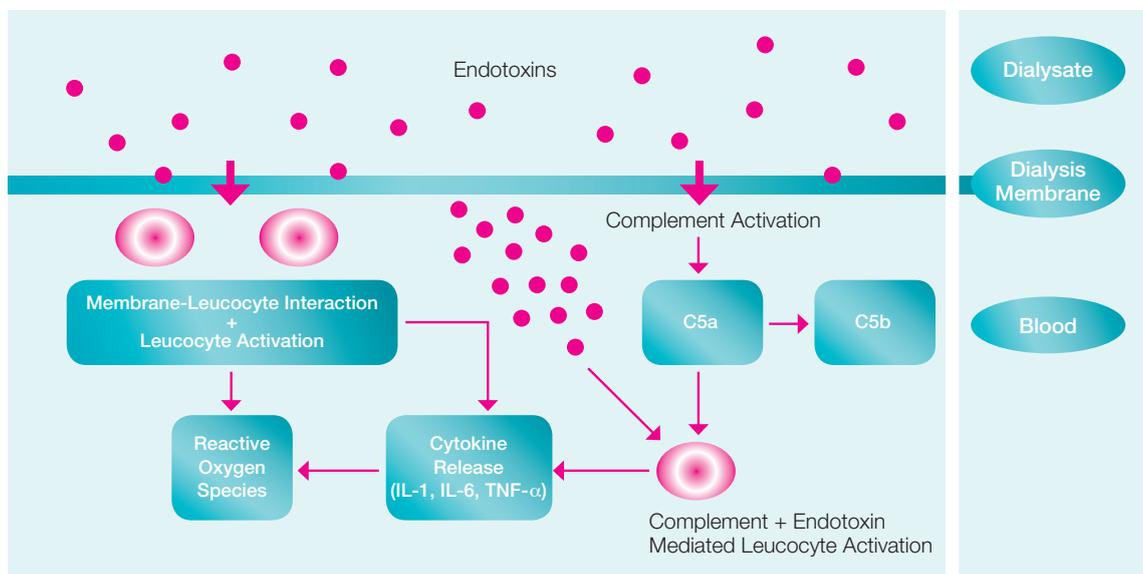
Microbial contamination of water or fluid conduits can therefore lead to the presence of endotoxins in dialysis fluid.

While intact endotoxins are relatively large molecules, their smaller endotoxin fragments may pass across dialysis membranes into the patient's blood via backdiffusion or backfiltration.

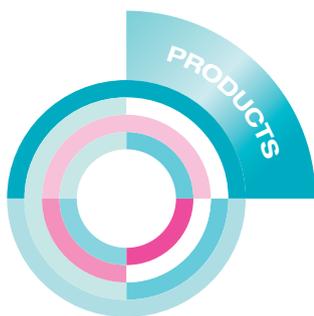
Greater protection through active prevention

Once in the patient's blood, endotoxins can induce complement and leucocyte activation, leading to inflammatory responses.

Sometimes, these may result in acute reactions such as fever, headaches, convulsions or low blood pressure. In the longer term, they may also contribute to chronic conditions such as amyloidosis, an increased need for EPO, immune disorders or accelerated atherosclerosis. Atherosclerosis and cardiovascular diseases are the most frequent causes of death for dialysis patients.



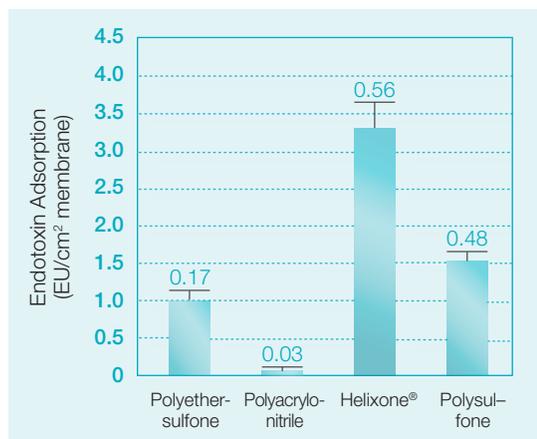
Inflammatory responses simulated by blood-membrane interactions and bacterial dialysate contaminants.



Membranes, such as Helixone[®], which have a high endotoxin retention capacity, protect the patient from inflammation, particularly when ultrapure dialysate is not available.¹

SPOT on:

- Absence of endotoxins minimises inflammation.
- Reduced cardiovascular risk factors.



Endotoxin adsorption per cm² membrane surface area after 120 min in-vitro dialysis with contaminated dialysate (endotoxin from bacterial culture filtrates; initial concentration 50 EU/mL).¹

(Graph adapted from original publication)

How to prevent endotoxins entering dialysis fluids

- Improved overall hygiene management.
- Mandatory use of ultrapure dialysis fluid by using dialysis fluid filters such as DIASAFE^{®plus} to remove residual endotoxins from dialysis fluid.
- Use of dialysis membranes with high endotoxin retention capacities, particularly when ultrapure dialysate is not available (e.g. Helixone[®] or Helixone^{®plus}).

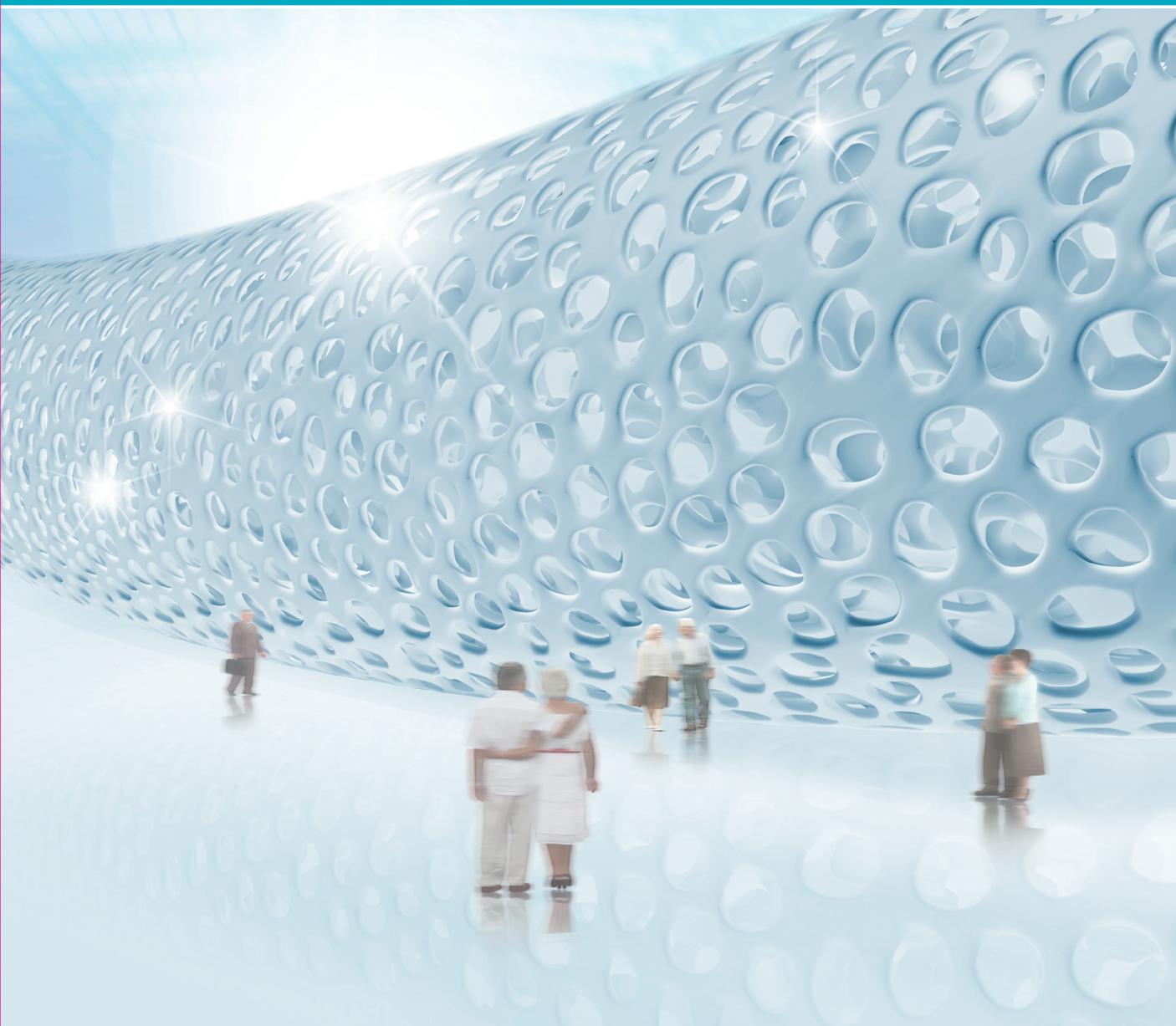
Reference

¹ Weber V. et al., Blood Purif (2003); 21: 365.

Cardioprotective Haemodialysis

Open up to Porosity

Enhanced Middle Molecule Removal



Cardioprotective Haemodialysis **SPOT**



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Protect your Patient

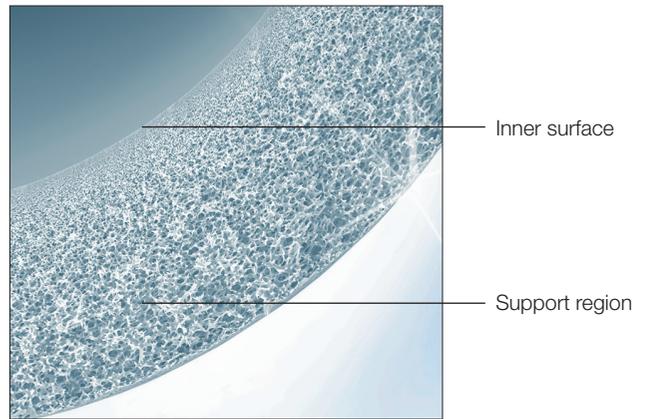
Key to optimal middle molecule removal

Solutes encounter resistance while traversing the membrane wall. Resistance to solute transport is affected, in part, by pore size at the inner surface and the porosity of the membrane wall.

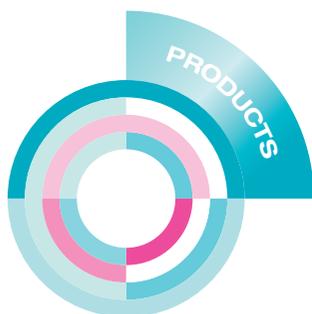
Furthermore, wall structure and thickness as well as inner fibre dimensions and 3-dimensional microwave structure, play important roles in transmembrane flux.

The new membrane structure of Helixone[®]*plus* allows the easy passage of middle molecules across the more porous support region of the membrane.

- The structure of the support region is crucial to overall performance.
- Membrane porosity, together with the pore size, regulates the transport of middle molecules.



Close-up of the inner surface and the support region of the Helixone[®]*plus* membrane.



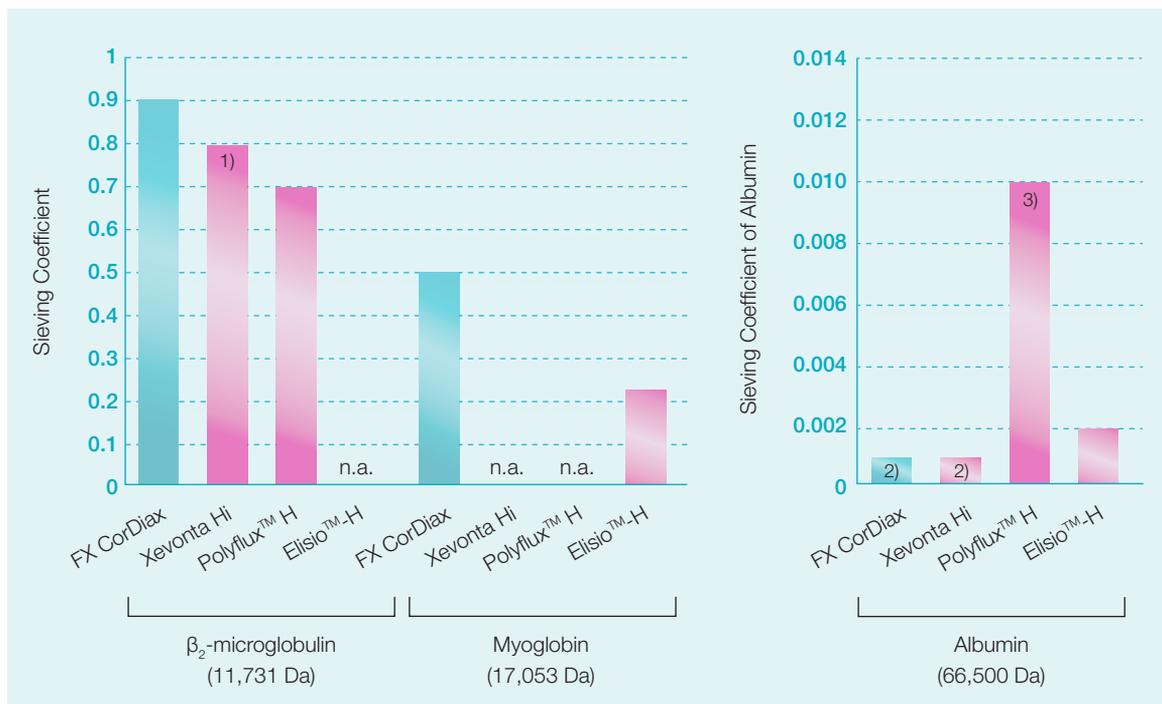
Refined membrane architecture

New production technology combined with INLINE steam sterilisation allows crucial enhancements of membrane porosity, reducing flow resistance and improving transport across the membrane.

- Significantly improved removal of middle molecules while preventing the loss of useful substances, such as serum albumin.

SPOT on:

- Optimised membrane porosity for enhanced removal of middle molecules.



Comparison of sieving coefficients of FX CorDiax, Xevonta Hi, Polyflux™ H, and Elisio™-H.

(All data taken from manufacturer's brochures. ¹⁾ > 0.8, ²⁾ < 0.001, ³⁾ < 0.01)

Cardioprotective Haemodialysis

Improved Survival - Better Outcomes

High-Flux Dialysis

High-Flux Dialysis



Cardioprotective Haemodialysis **SPOT**



**FRESENIUS
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Protect your Patient

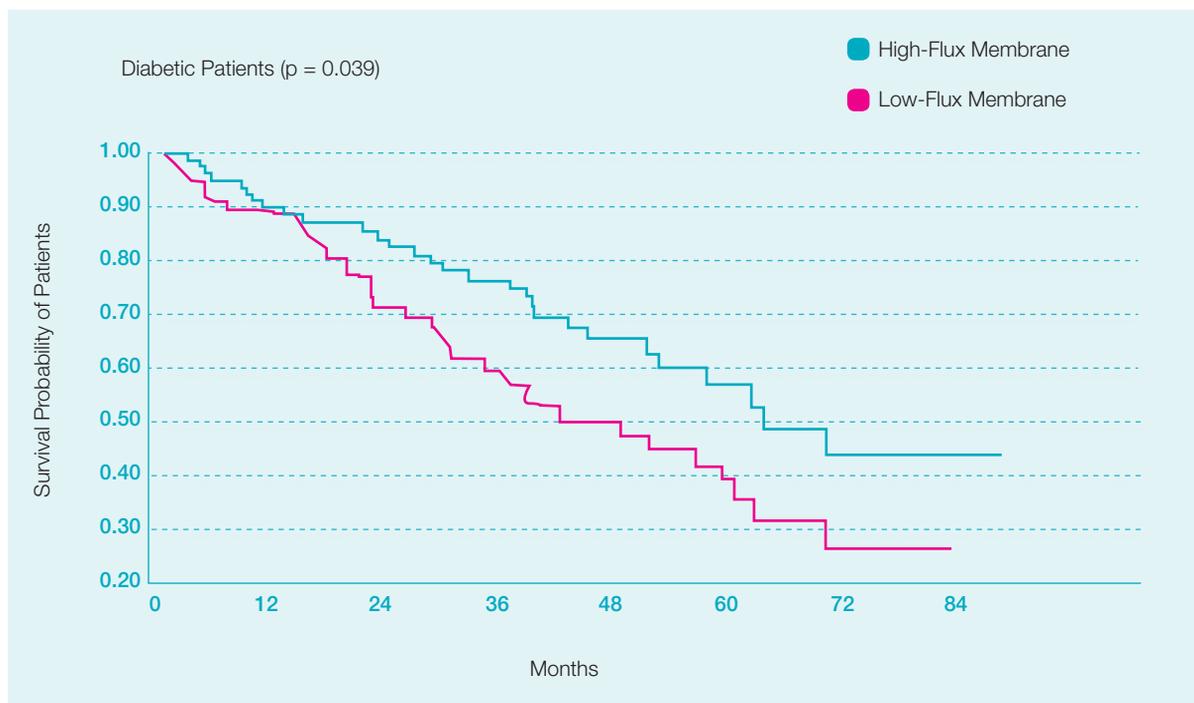
Extended survival

Use of High-Flux membranes enhances the removal of uremic toxins, particularly middle molecules such as β_2 -microglobulin.

A growing body of evidence has emerged in recent years demonstrating that use of High-Flux dialysis membranes as well as advanced treatment modalities such as ONLINE Haemodiafiltration

(ONLINE HDF) may contribute towards reduced risk of death.

The results of the MPO study indicate the beneficial effect of High-Flux membranes in terms of reduced mortality for patients with serum albumin levels ≤ 4.0 g/dL or diabetes.¹



Kaplan-Meier survival curves for the subpopulation of patients with diabetes (log-rank test $p = 0.039$).¹

(Graph adapted from original publication)



Reduced complications

Enhanced middle molecule removal contributes towards reducing the complications of haemodialysis as well as improving long-term patient outcomes by affecting:²

- **Inflammation** – lower CRP levels.³
- **Anaemia** – haemoglobin levels improve at lower EPO doses.⁴
- **Amyloidosis** – efficient removal of β_2 -microglobulin and other middle molecules can reduce the relative risk of developing amyloidosis by up to 50%.^{5, 6}
- **Immune dysfunction** – aberrant suppression of IFN- γ may be corrected.⁷

The clinical benefits of High-Flux HDF are described in more detail in the chapter »Clinical Benefits of the Removal of Middle Molecules«.

SPOT on :

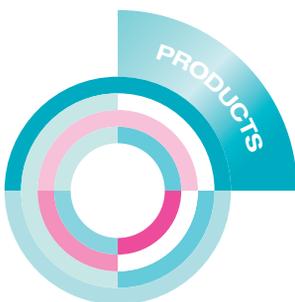
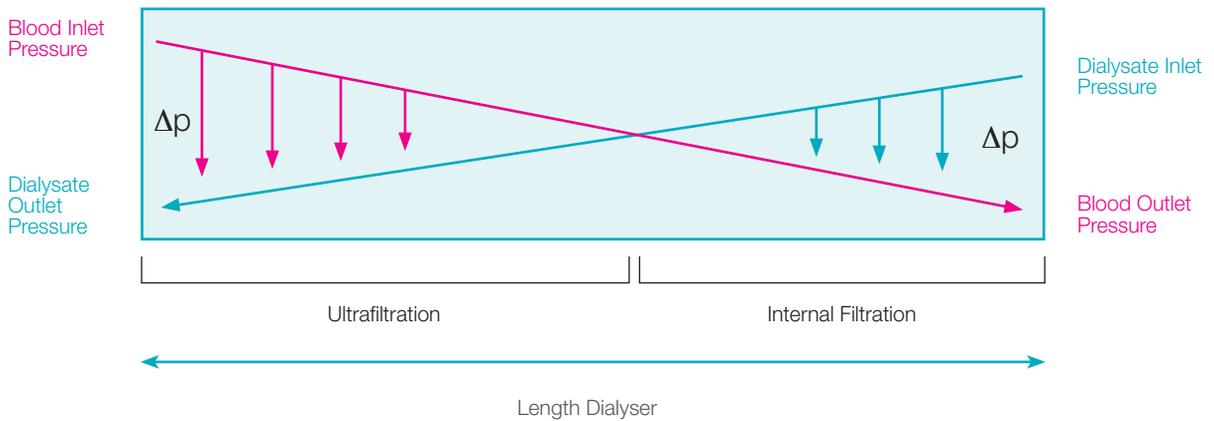
- High-Flux dialysis can reduce secondary diseases.
- Prolonging patients' lives.¹
- Control of anaemia and amyloidosis.

Protect your Patient

Evolution of fibre design

Reducing the inner fibre diameter from 200 μm to 185 μm acts to increase internal filtration, thereby increasing the pressure gradient along the length of the fibre. This results in a greater pressure difference between the blood and dialysate com-

partments. Together with structural refinements to the support region of the fibre, this enables improvements in both diffusive and convective transport, which is of particular importance when performing High-Flux haemodialysis.



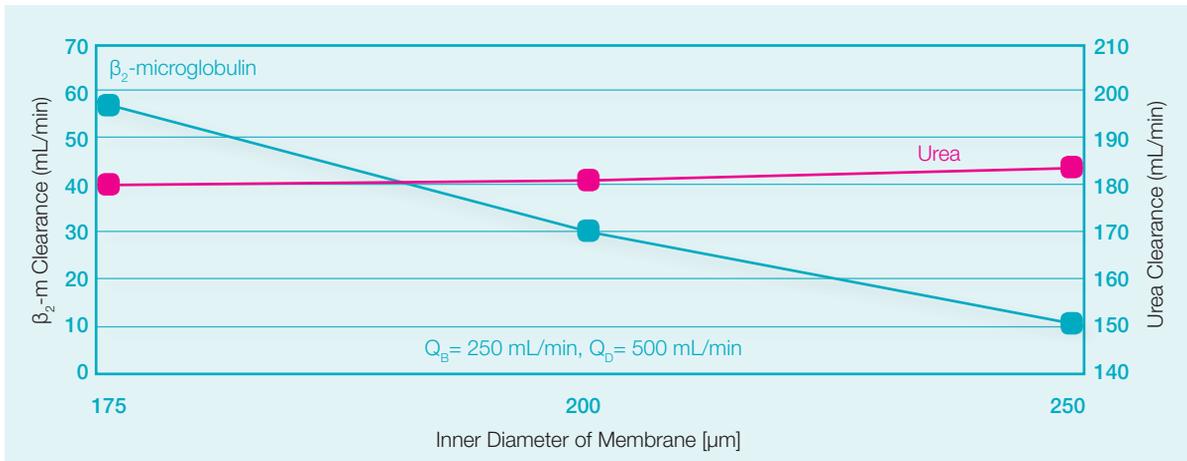
References

- 1 Locatelli F. et al., Journal of American Society of Nephrology (2009); 20: 645-654.
- 2 Tattersall J. et al., Nephrol Dial (2007); 22(Suppl.2); ii5-ii21.
- 3 Pedrini L. A. et al., Nephrol Dial Transplant (2011); doi: 10.1093/ndt/gfq761.
- 4 Merello Godino J. I. et al., Int J Artif Organs (2002); 25(11): 1049-1060.

- Modification of the inner diameter increases the pressure gradient between blood and dialysate compartments.
- The increased pressure gradient combined with structural refinements to the membrane (support region) enhances diffusive as well as convective filtration, especially when performing High-Flux haemodialysis with FX CorDiax.
- The result is improved clearance of middle molecules such as vitamin B₁₂, inulin, β_2 -microglobulin and myoglobin.⁸

SPOT on:

- Specific fibre design leads to increased removal of middle molecules.



Reduced inner diameter improves middle molecule elimination.⁸

(Graph adapted from original publication)

5 Koda Y. et al., Kidney Int (1997); 52: 1096-1101.
 6 Locatelli F. et al., Kidney Int (1999); 55: 286-293.
 7 Lonnemann G. et al., Blood Purif (2003); 21(3): 225-231.
 8 Dellanna F. et al., (1996); NDT 11 (Suppl 2): 83-86.

Cardioprotective Haemodialysis

Advance the Experience

ONLINE Haemodiafiltration



Cardioprotective Haemodialysis **SPOT**



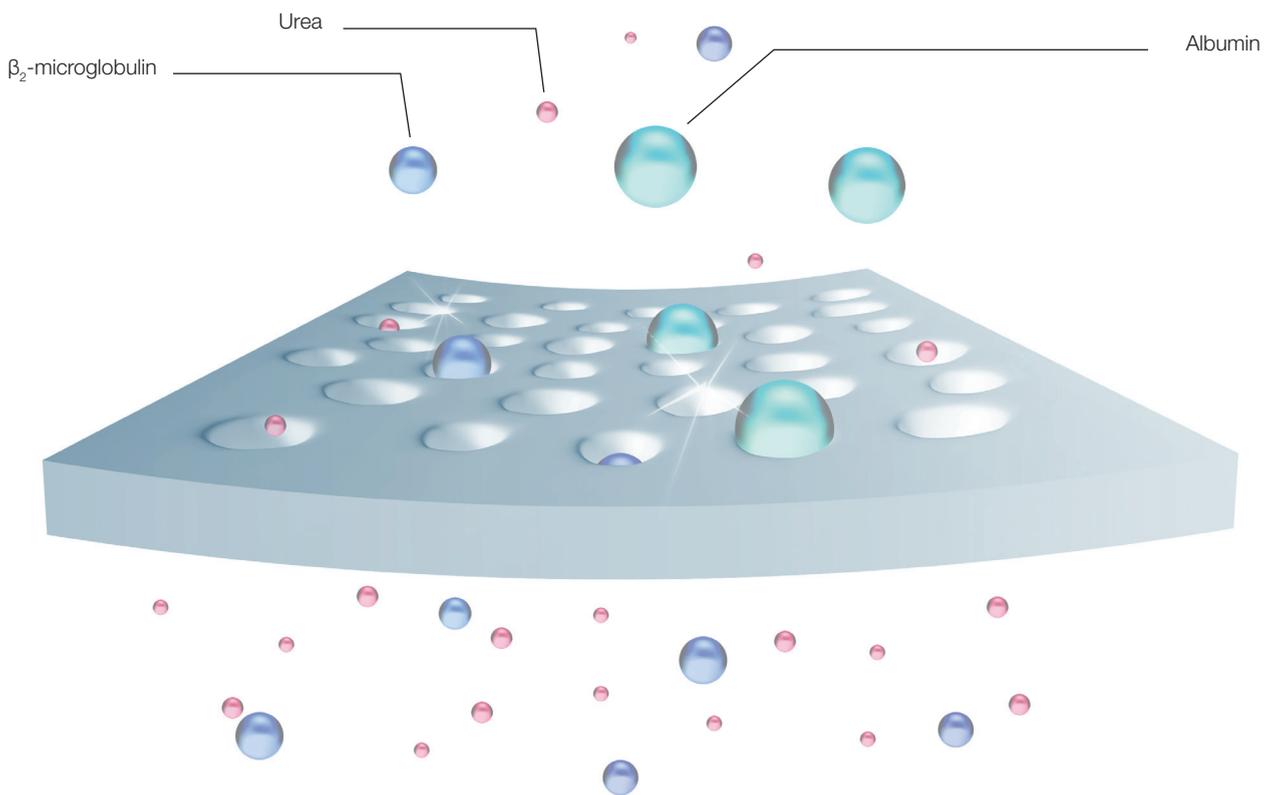
**FRESENIUS
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Better filtration

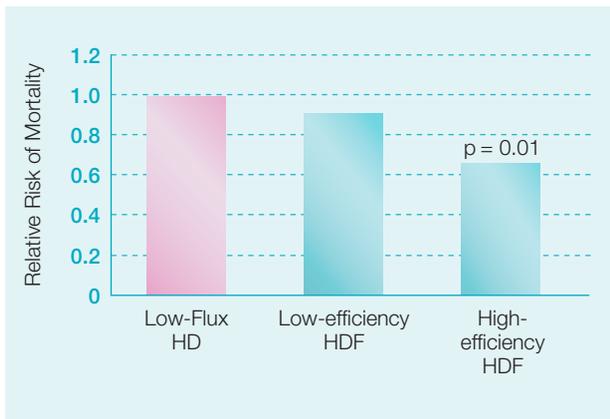
In recent years, there has been increased interest in more efficient haemodialysis treatment modalities. The main emphasis today is on the efficient removal of a wide range of uremic toxins, particularly larger middle molecules such as β_2 -microglobulin, a surrogate of middle molecules. However, excessive loss of useful substances such as albumin needs to be curtailed.

The high removal of larger solutes during ONLINE Haemodiafiltration (ONLINE HDF) is achieved through a combination of two principles: diffusion and convection. Solute removal by convection occurs along a pressure gradient facilitated by the ultrafiltration of fluid across a highly permeable membrane.



Improved survival

In an observational study involving 2,165 patients, high-efficiency ONLINE HDF has been shown to be associated with improved patient survival.¹



In comparison to Low-Flux HD, HDF with high fluid exchange rates of between 15 and 25 L per treatment significantly reduces mortality among dialysis patients.¹

(Graph adapted from original publication)

In another prospective epidemiological study, a mortality risk reduction of 35% was observed after adjustment was made for age, gender, comorbidities and time on renal replacement therapy.²

SPOT on:

- High convective transport enhances the removal of uremic toxins, especially in the middle molecular range.

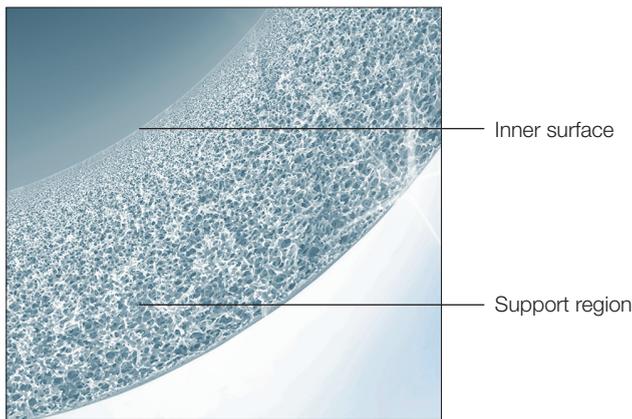
Protect your Patient

Refined structure for enhanced porosity

A fundamental prerequisite for the successful implementation of ONLINE HDF is the use of specifically designed High-Flux membranes which have high sieving coefficients for middle molecules.

In addition, the membranes must permit high exchange volumes to maximise the convective component of solute removal in ONLINE HDF.

The FX CorDiax haemodiafilter range was specifically designed to meet the requirements of high-volume therapies.



Close-up of the inner surface and the support region of the Helixone[®]plus membrane.

- **Enhanced porosity of membrane wall**

The architecture of the support region of the Helixone[®]plus membrane wall has been further refined to increase porosity to allow large transmembrane flux.

- **Improved fluid dynamics**

The increased inner diameter of the fibres optimises the flow characteristics during haemodiafiltration. Higher exchange volumes also serve to increase convection, which is important for the removal of larger uremic toxins.



High-efficiency haemodiafiltration

The removal of high volumes of fluid facilitates the removal of middle molecules by convection across the membrane wall. High-efficiency ONLINE Haemodiafiltration (exchange volume >15 L) promotes even higher removal of uremic toxins than High-Flux haemodialysis.³

SPOT on:

- High exchange volumes during ONLINE HDF treatment lead to a higher middle molecule removal.
- The higher removal of middle molecules minimises the risk factors for cardiovascular diseases and other comorbidities such as amyloidosis or anaemia.

References

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Cardioprotective Haemodialysis

When Performance is Priority

Clinical Benefits of the Removal of Middle Molecules



Cardioprotective Haemodialysis **SPOT**

Clinical Benefits of the Removal of Middle Molecules

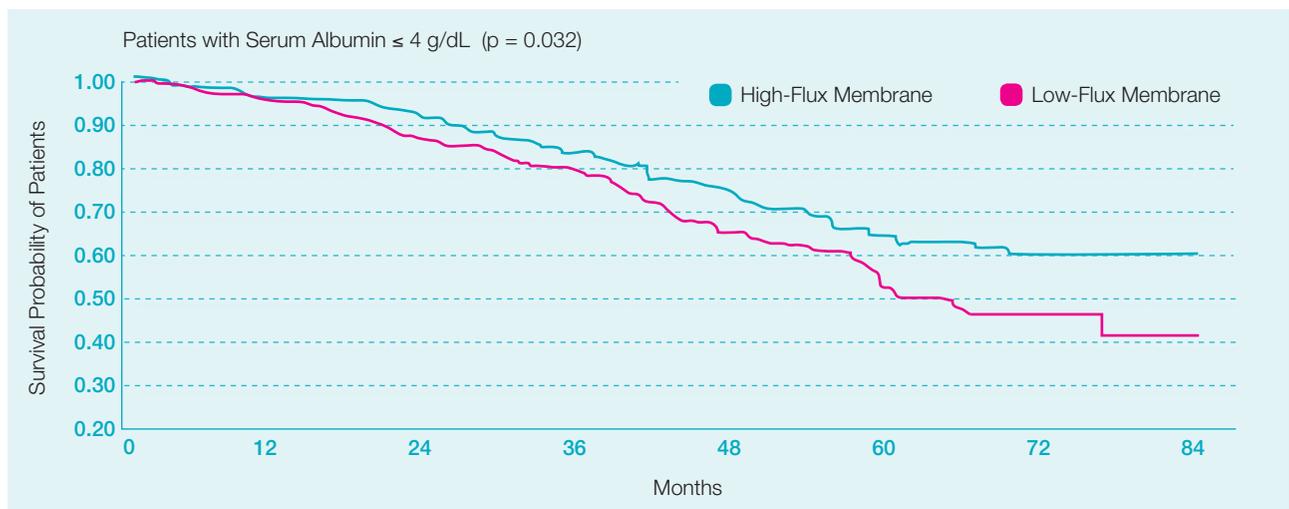


**FRESENIUS
MEDICAL CARE**

Protect your Patient

Improved survival with High-Flux membranes

A number of recent studies have shown the advantages of High-Flux vs Low-Flux membranes. Patient survival rates using High-Flux membranes are significantly increased vs Low-Flux membranes for patients with low serum albumin (≤ 4 g/dL) or with diabetes which afflict almost 70% of all haemodialysis patients.¹



Kaplan-Meier survival curves for the population of patients with serum albumin levels ≤ 4.0 g/dL (log-rank test $p = 0.032$).²
(Graph adapted from original publication)

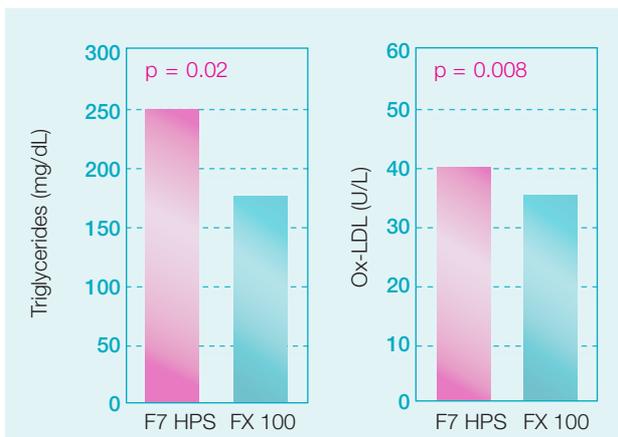


Cardioprotective Haemodialysis

- Dyslipidaemia** – the use of High-Flux Helixone® membranes improves plasma lipid profiles,³ reducing levels of LDL (low-density lipoprotein) and VLDL (very low-density lipoprotein) and increasing those of protective HDL (high-density lipoprotein). The levels of triglycerides and oxidised LDL, an indicator of oxidative stress and a specific risk factor for atherosclerosis, are also significantly reduced using Helixone® membranes.⁴

SPOT on:

- Improved patient survival.²
- Reduced risk factors of atherosclerosis.⁴

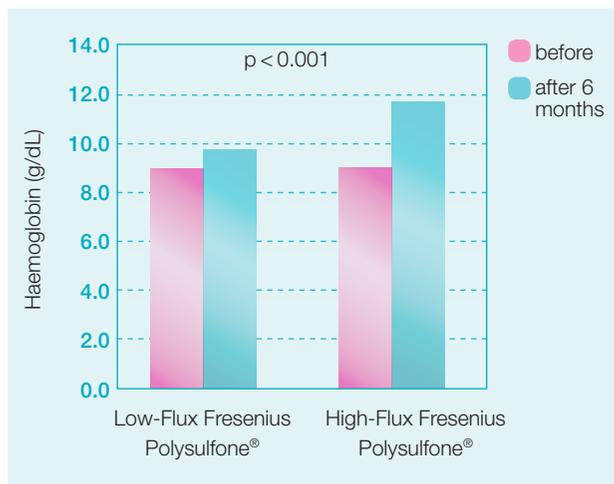


Improving plasma lipid profiles: reduction of ox-LDL and triglycerides with FX 100 dialysers.⁴

(Graph adapted from original publication)

Cardioprotective Haemodialysis

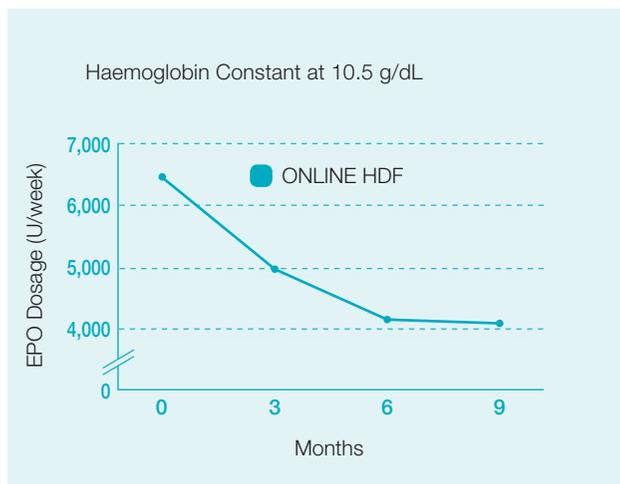
- Anaemia** – patients with chronic kidney disease (CKD) require supplementary EPO to compensate for inadequate EPO production. In addition, EPO resistance may occur, with inflammation being a major contributing factor.⁵ Various studies have shown that use of High-Flux vs Low-Flux membranes may improve control of anaemia, while at the same time allowing a progressive reduction in the exogenous EPO dose.



Recovery of haemoglobin (Hb) levels were significantly better after 6 months for patients treated using High-Flux vs Low-Flux membranes. EPO dose after 6 months was also substantially lower for High-Flux vs Low-Flux treated patients.⁶

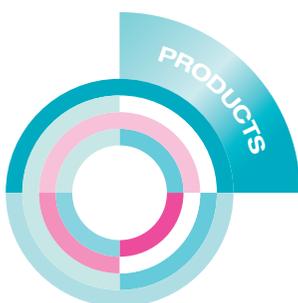
(Graph adapted from original publication)

- Amyloidosis** – a debilitating complication of longterm haemodialysis, amyloidosis involves the build-up of β_2 -microglobulin. FX-class® High-Flux dialysers efficiently remove β_2 -microglobulin and other middle molecules, reducing the risk of carpal tunnel syndrome.^{8,9}



With High-Flux membranes, it was possible to progressively reduce the EPO dose while maintaining Hb control.⁷

(Graph adapted from original publication)





- **Inflammation** – specialised production processes such as INLINE steam sterilisation as well as the high endotoxin retention properties of FX-class® dialysers contribute to reducing the levels of endotoxin exposure during haemodialysis. This results in the reduced induction of inflammatory responses.³

The FX CorDiax allows the enhanced removal of middle molecules which, together with other factors, contributes towards improved survival.

SPOT on:

- Improved anaemia control.^{6,7}
- Reduced inflammation.³
- Reduced risk of CVD due to minimising the risk factors.

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