



8:e Svenska Accessmötet 13-14 november 2025

Swedish Access Meeting,
November 13–14, 2025

**MuST: Multiple Single Canulation
Technique**

Ricardo Peralta

Swedish Access Meeting, November 13–14, 2025

Background



BRS VASCULAR ACCESS
Special Interest Group



Clinical Practice Recommendations for Needling of Arteriovenous Fistula and Grafts for Haemodialysis



Incorrect techniques can lead to complications including stenosis and aneurysm development, infections, haematoma, pseudoaneurysm, bleeding and pain.



Ensuring a good technique will reduce such complications and prolong the life-span of the AV access.



In the first Patient Reported Experience Measure (PREM) in the UK, **needling was identified as one of 3 issues of concern for renal patients**



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- Vi vet alla att en misslyckad/dålig stickteknik kan leda till komplikationer som aneurysm och stenosis, infektioner, blåmärken, blödningar och smärta.
- Men vilken är den bästa sticktekniken för att bevara AV-fisteln?

Background - Area cannulation technique - Recommendations

ESVS (2018)

This technique is less used **and is not recommended**

KDOQI (2019)

... the Working Group agreed on a cautious approach in approaching the patient's lifeline with the decision to **prefer the RL** cannulation technique

Spanish CG (2017)

... Therefore, this method should be avoided whenever possible. However, the current situation in the **"real world" is disappointing**

VASBI/BRS (2018/2019)

Recommendation I

Area puncture needling technique **should be avoided** wherever possible, and we recommend the use of RL or BH needling technique on all AVF and grafts, whenever it is possible

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Riktlinjerna avråder från area puncture. Spanska riktlinjer nämner hur det verkligen ser ut: *“den nuvarande situationen i den ‘verkliga världen’ är en besvikelse”*.

Background - Area cannulation technique - Recommendations

□ G. Kronung, MD, Chirurgische Universitätsklinik, 5300 Bonn, German Federal Republic

Plastic Deformation of Cimino Fistula by Repeated Puncture

Repeated puncture of Cimino fistula can be called a plastic vascular operation in installments, leading to aneurysmatic and stenotic deformation. Knowledge of the different puncture techniques and their morphologic consequences means that the stenotic deformations can be avoided and the aneurysmatic effect used to gain optimal response to correct the fistula vein. Each nephrologist performing dialysis has an important, protective duty for the long-term function of the Cimino fistulas of his patients.

DESCRIPTION OF PRINCIPLE

Each fistula puncture causes a small tissue displacement, filled by a thrombus after removal of cannula. The organization of the thrombus results in a small tissue increase, which causes a plastic elongation of the front side of the vessel wall and the covering skin in the puncture area. This elongation () leads to an aneurysmatic dilatation of the center of the puncture area, whereas the border often tends to a stenotic folding (1) of the vessel wall (Figure 1).

Moreover, repeated punctures destroy the contractile and elastic elements of the vessel wall. Replacement scar tissue is less resistant to chronic burden of the increased blood pressure. Additionally, after the law of Bernoulli:

load; and stenoses become more stenotic independent of further punctures (decreased pressure load, intinaproliferation). The vicious circle initiated in this way can lead to the loss of fistula function by progressive dilatation (rarely) or progressive stenosis (often).

Varying parameters for the degree of dilatation are:

- Number of punctures per area unit,
- Kind of cannulas (anticoring),
- Puncture technique (especially the angle between cannula and skin during insertion),
- Blood coagulation,
- Blood pressure in the fistula vein,
- Degree and duration of compression after cannula removal,
- Individual disposition.

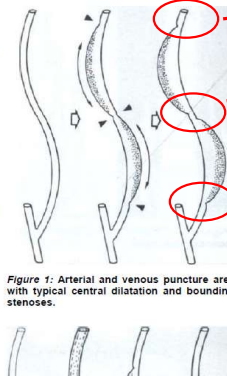


Figure 1: Arterial and venous puncture area with typical central dilatation and bounding stenoses.



Picture source: NephroCare Portugal SA database

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Som du kan se på den här bilden leder area puncture till utveckling av aneurysm samt stenosbildning före och efter dessa aneurysm

Background - Buttonhole technique - Recommendations

ESVS (2018)

Recommendation 42

In patients with a **short cannulation segment** the use of the buttonhole technique should be considered over other techniques.

KDOQI (2019)

Guideline 11.3

KDOQI considers it reasonable to limit AV access buttonhole cannulation only to **special circumstances** given the associated increased risks of infection and related adverse consequences.

Spanish CG (2017)

R 3.3.6

It is recommended that the buttonhole technique is reserved as the cannulation technique for tortuous, deep native arteriovenous fistulas and/or those with a very limited length of venous segment.

BRS/VASBI (2018)

We recommend the use of RL or BH needling technique on all AVF and grafts, **whenever it is possible**.

Å andra sidan rekommenderar riktlinjerna

BH ska endast användas till patienter med kort sticksträcka och i speciella situationer. Detta med anledning av högre risk för infektioner och de konsekvenser det medför

Background - Buttonhole technique - The reality

Original Investigation

AJKD

Risk of Vascular Access Infection Associated With Buttonhole Cannulation of Fistulas: Data From the National Healthcare Safety Network

Meghan Lyman, Duc B. Nguyen, Alicia Shugart, Heidi Gruhler, Christi Lines, and Priti R. Patel

Rationale & Objective: Compared with conventional (rope-ladder cannulation [RLC]) methods, use of buttonhole cannulation (BHC) to access arteriovenous fistulas (AVFs) may be associated with increased risk for bloodstream infection and other vascular access-related infection. We used national surveillance data to evaluate the infection burden and risk among in-center hemodialysis patients with AVFs using BHC.

Study Design: Descriptive analysis of infections and related events and retrospective observational cohort study using National Healthcare Safety Network (NHSN) surveillance data.

Setting & Participants: US patients receiving hemodialysis treated in outpatient dialysis centers.

Predictors: AVF cannulation methods, dialysis facility characteristics, and infection control practices.

Outcomes: Access-related bloodstream infection; local access-site infection; intravenous (IV) antimicrobial start.

Analytic Approach: Description of frequency and rate of infections; adjusted relative risk (aRR) for infection with BHC versus RLC estimated using Poisson regression.

Results: During 2013 to 2014, there were 2,466 access-related bloodstream infections, 3,169 local access-site infections, and 13,726 IV antimicrobial starts among patients accessed using BHC. *Staphylococcus aureus* was the most common pathogen, present in half (52%) of the BHC access-related bloodstream infections. Hospitalization was frequent among BHC access-related bloodstream infections (37%). In 2014, 9% (n = 271,980) of all AVF patient-months reported to NHSN were associated with BHC. After adjusting for facility characteristics and practices, BHC was associated with significantly higher risk for access-related bloodstream infection (aRR, 2.6; 95% CI, 2.4-2.8) and local access-site infection (aRR, 1.5; 95% CI, 1.4-1.6) than RLC, but was not associated with increased risk for IV antimicrobial start.

Limitations: Data for facility practices were self-reported and not patient specific.

Conclusions: BHC was associated with higher risk for vascular access-related infection than RLC among in-center hemodialysis patients. Decisions regarding the use of BHC in dialysis centers should take into account the higher risk for infection. Studies are needed to evaluate infection control measures that may reduce infections related to BHC.

Complete author and article information provided before references.

Correspondence to: M. Lyman (mlyman@cdc.gov)

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doi: 10.1053/j.ajkd.2019.11.006

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- This is a retrospective observational study that compared BH with RL from the National Healthcare Safety Network (CDC)

- Involved: n = 271.980 patients with AVF

Concluded:

- **BH was associated with:**

- Significantly higher risk of access-related bloodstream infections. (*Staphylococcus aureus* 52% versus 32%); (aRR, **2.6**; 95% CI, 2.4-2.8).

- Local access infections (aRR, 1.5; 95% CI, 1.4-1.6)

- Hospitalization was frequent among patients with BH

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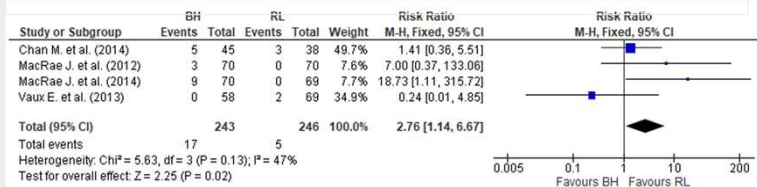
En observationsstudie som nyligen publicerades av National Healthcare Safety Network som inkluderade 271 000 patienter visade att BH associerades med significant högre fler accessrelaterade infektioner som sepsis, lokala infektioner och sjukhusinläggningar. Trots återkommande utbildningsprogram och granskning så kvarstod infektionsrisken.

Background - Buttonhole technique - The reality

Systematic Review Cannulation Technique of Vascular Access in Hemodialysis and the Impact on the Arteriovenous Fistula Survival: Systematic Review and Meta-Analysis

Ricardo Peralta ^{1,2,*}, Luis Sousa ^{3,4,5} and António Filipe Cristovão ¹

Result of the number of interventions in the AVF between the buttonhole and the rope ladder

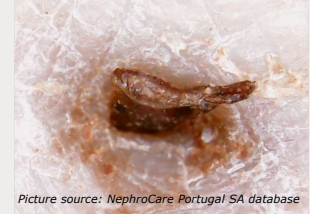


Peralta, R. et al. "Cannulation Technique of Vascular Access in Hemodialysis and the Impact on the Arteriovenous Fistula Survival: Systematic Review and Meta-Analysis." *Journal of Clinical Medicine* 12.18 (2023): 5946.

- The test showed homogeneity between studies, and using the fixed effects model ($p > 0.1$ and $I^2 = 47\%$)
- A significant difference was observed in the incidence of bacteraemia associated with BH (RR, **2.76** (95% CI 1.14 - 6.67) $p = 0.02$).

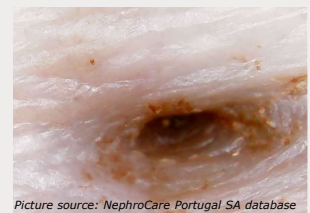
Buttonhole technique

Pictures enlarged by 500x



Picture source: NephroCare Portugal SA database

Tunnel with scab



Picture source: NephroCare Portugal SA database

Tunnel without scab

Photos author: Rui Sousa

Risken för bakteremi är kopplad till stickkanalen. Även om sårskorpan tas bort och desinfektion utförs kan små bitar av sårskorpan bli kvar och föras in i stickkanalen och blodbanan.

Background - Rope-ladder cannulation - Recommendations

ESVS (2018)

Recommendation 43

The rope ladder technique should be used for cannulation of **arteriovenous grafts**

KDOQI (2019)

Guideline 11.2

KDOQI recommends rope ladder cannulation as the preferred cannulation technique **for AVFs**.

Spanish CG (2017)

R 3.3.5

It is recommended to use ropeladder as the primary cannulation technique for **native arteriovenous fistula**.

BRS/VASBI (2018)

Recommendation F.1

3. We recommend either rope ladder or buttonhole technique is chosen for AV fistulae and rope ladder for AV grafts.

Och riktlinjerna rekommenderar ropeladder för AV-fistlar.
Ropeladder ska användas till patienter med AV-graft

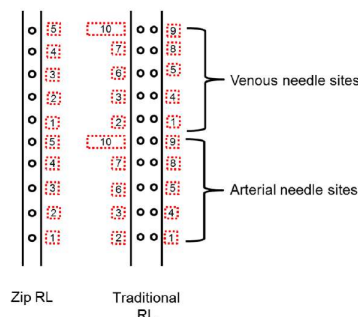
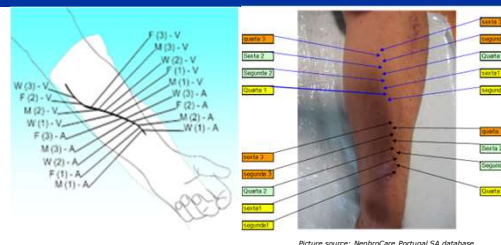
Background - Rope-ladder cannulation - Recommendations

Buttonhole needling of haemodialysis arteriovenous fistulae results in less complications and interventions compared to the rope-ladder technique

Magda M. van Loon¹, Tony Goovaerts², Alfons G. H. Kessels³, Frank M. van der Sande⁴ and Jan H. M. Tordoir¹

Nephrol Dial Transplant (2010) 25: 225–230

The result of using the rope-ladder technique is only a small dilatation effect over a greater length [5]. We observed a significant number of aneurysms in patients exhibiting the rope-ladder technique. This finding suggests that, although the protocol prescribes the use of the rope-ladder method, the dialysis staff in daily practice may use the area technique.

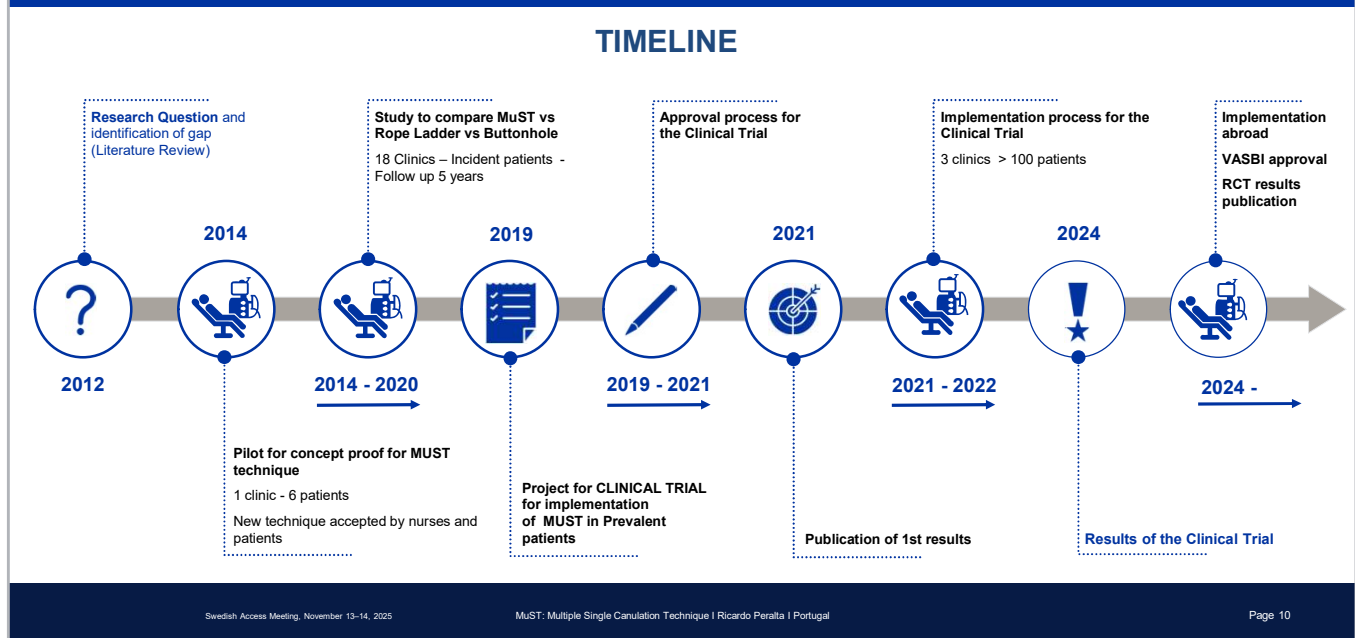


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MuST: Multiple Single Cannulation Technique | Ricardo Peralta | Portugal

Detta är en observationsstudie som jämför buttonhole och ropeladder. I den studien kunde man se signifikant fler aneurysm hos patienter som använde ropeladder.

MuST implementation timeline



Hur föddes/skapades MuST?

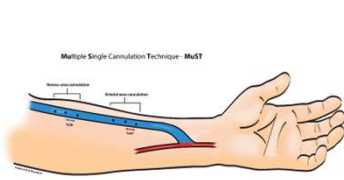
Det började på Viseu's NephroCare Clinic omkring 2013 med en pilotstudie

Under 2014 testades MUST på en dialysenhet i en randomiserad kontrollerad studie (RCT) där teknikerna MuST, ropeladder och buttonhole jämfördes. I studien lottades deltagarna till vilken stickteknik de skulle använda. Nya patienter i dialys inkluderades under fem år och följdes i studien under ett år.

2021 startades en andra klinisk prövning och preliminära resultat är publicerade.

Tekniken började spridas utomlands framförallt till Spanien, Storbritannien och Italien.

MuST – Multiple Single Cannulation Technique



Picture source: Picture from the author and Nephrology Nursing Journal, 48(2), 169-176



Picture source: Picture from the author and Arch Nephrol Ren Stud. 2021;1(1)28-33.



Picture source: Picture from the author and Hemodialysis International. 2022;26:4-12

- This CT consists of rotating the same six specific cannulation sites, three arterial and three venous, through the three treatment days of each week.
- Two areas of arterial and venous cannulation were created, with three cannulation points each at least 1 cm apart.

Och utmaningen ledde till att vi implementerade en ny stickteknik som kallades MuST (Multipel stickhålsteknik)

MuST är en hybrid mellan ropeladder och buttonhole och utnyttjar fördelarna från båda teknikerna.

Multipel=ropeladder

Single=buttonhole

How to implement MuST



Picture source: Picture from the author of the presentation

Picture source: Picture from the author of the presentation

Picture source: Picture from the author of the presentation

- Experienced nurses or physicians should select patients according to inclusion criteria.
- Straight paths of at least 3 cm length should be chosen for each cannulation area, both arterial and venous.

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Vascular access -

Hur ska MuST implementeras?

I en ny fistel ska man välja stickplatser längs hela fistelns längd.

How to implement MuST



- Areas with aneurysms should be avoided; however, spots at the bottom of aneurysms with greater tissue integrity may be chosen.

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Vascular access -

Områden med aneurysm bör undvikas. Det går dock att använda basen på aneurysm för stick då kärlväggen fortfarande är intakt där.

How to implement MuST

- Select and identify cannulation spots with a pen until their location is easily visible due to skin depigmentation.
- The distance between each cannulation spot must be symmetrical and above 1 cm.
- Generally, after 8 to 12 consecutive cannulations at the same site, a fibrotic and depigmented tissue develops and subsequently identifies the exact spot.



Pictures source: Picture from the author of the presentation

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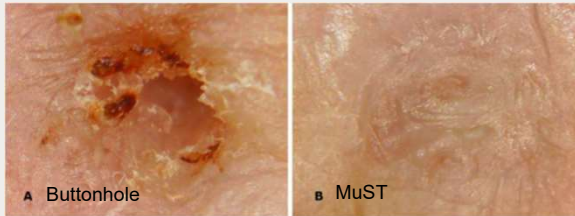
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Vascular access -

Markera ut de valda stickplatserna med en vattenfast penna tills stickhålen syns som ändring i pigmentet. Oftast brukar hålen synas efter 8-12 stick på samma plats.

Markering med pilar verkar vara det bästa sättet att markera hålen.

Successful and Safe Cannulation Technique



Picture source: Picture from the author and Arch Nephrol Ren Stud. 2021;1(1):28-33.

- **Blunt needles are not required**, and a fibrotic tunnel track formation is not expected to occur, because the last site cannulated will heal in a week.

- It is **not necessary** to have the **same nurse** performing the first cannulations.
- **No additional care** is required than the recommended care for RL cannulation.
- In the presence of **peri-needle bleeding** during treatment, **new cannulation sites** can be implemented.



Picture source: Picture from the author

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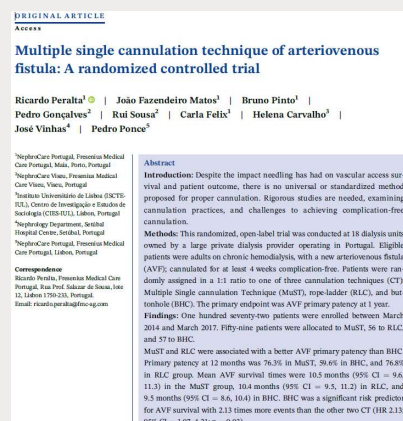
10/11/2025

Vid MuST behövs inga trubbiga nålar. Här kan du se en jämförelse mellan instickställe för buttonhole och MuST.

- En stickgrupp/par sjuksköterskor som sticker upp är inte nödvändigt för att skapa stickkanal
- Om blödning/läckage uppstår kan ny stickplats skapas som i exemplet på bilden

MuST Study I – INCIDENT Patients

- Randomised open-label trial was conducted at 18 dialysis units
- The study consisted of two phases:
 - 1st phase comprised a training of all the clinics' nursing teams;
 - 2nd phase patients were selected according to the inclusion criteria
- Eligible patients were adults on chronic haemodialysis, with a new arteriovenous fistula (AVF)
- Patients were randomly assigned in a 1:1 ratio to one of three cannulation techniques (CT): MuST, rope-ladder (RLC), and buttonhole (BHC).
- For MuST and RLC, individual diagrams of the AVF were created and attached to the patient's file
- Prior to cannulation, physical examination of the AVF was performed at every dialysis session
- All parameters were recorded in a specific vascular access database.
- Whenever a change in the physical or dynamic examination was identified, the patient was referred to the vascular access centre.

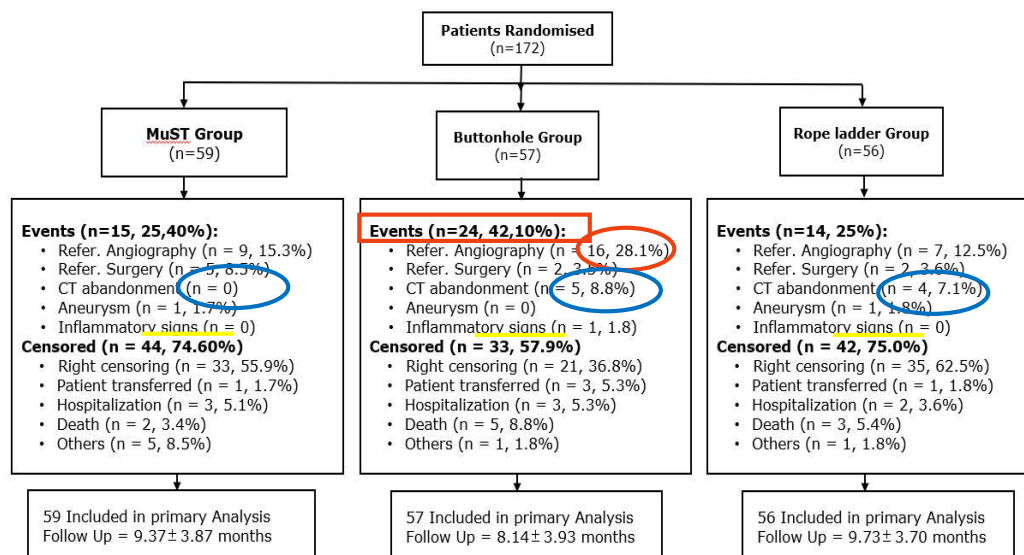


Vi genomförde en randomiserad kontrollerad studie på 18 kliniker med patienter med enbart nya AV-fistlar. Studien bestod av två faser:

- Den första fasen omfattade utbildning av alla dialysenhetens sjuksköterskor.
- I den andra fasen valdes patienter ut enligt inklusionskriterierna.

För MuST och RL skapades individuella diagram över fistlarna som bifogades patientens journal. Uppföljningen varade i ett år.

MuST Study I – INCIDENT Patients



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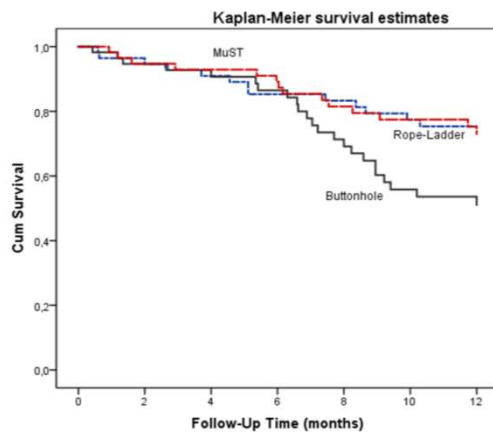
MuST: Multiple Single Catheter Technique | Ricardo Perilla | Portugal

10/11/2025

172 patienter deltog, fördelade på de tre stickteknikerna. I detta flödesschema kan vi se antalet händelser per stickteknik och de patienter som avbröt sitt deltagande av olika skäl. Vi visade att BH-gruppen är förknippad med en högre frekvens av remisser till angiografi än de andra två stickteknikerna. Anledningen till denna remiss var framförallt ett minskat flöde (Qa) i AV-fistlarna. Enligt de data som rapporterades dagligen av sjuksköterskorna avbröt 5 patienter BH och 4 RL på grund av svårigheter i samband med utförandet av sticktekniken och patientens vägran på grund av smärta.

MuST Study I - Results

AVF - Unassisted Patency



- The Kaplan-Meier analysis showed that AVF survival during the 1st 6 months in the 3 groups was overlapping.
- After the 6th month, the BH group survival curve decreased exponentially.
- AVF survival curve comparing the three groups of cannulation technique, MuST versus BH and versus RL. (log-rank test, $p = 0.033$).

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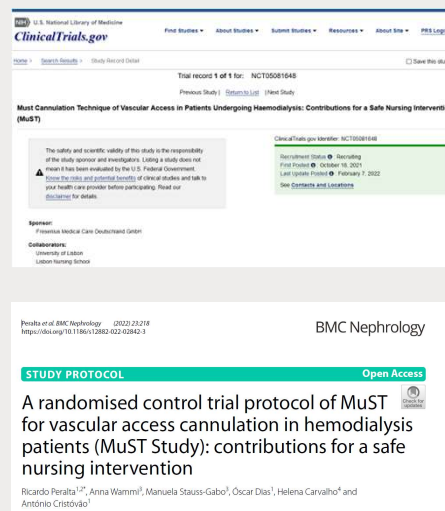
- Överlevnadskurvan som visas i den här bilden har en statistiskt säkerställd skillnad mellan buttonhole och de andra två grupperna.
- Buttonhole var en riskfaktor för förkortad fistelöverlevnad. I gruppen med buttonhole var risken för komplikation 2,1 gånger högre än de andra grupperna.
- MuST och ropeladder visar liknande fistelöverlevnad

MuST Study II – PREVALENT Patients

MuST Study II

The study was approved and sponsored by the Head Global Biomedical Evidence Generation, Fresenius Medical Care Deutschland GmbH.

- The aims of the MuST Study are to:
 - Determine the **AVF survival and complications rate** of patients submitted to MuST compared to those submitted to RL.
 - Analyze the **intensity of pain perceived by the patient** with each cannulation technique under study.
- Trial registration: ClinicalTrials.gov identifier **NCT05081648** registered on 18 October 2021.
- Publication the Study protocol on BMC Nephrology:
<https://rdcu.be/cP7rM>

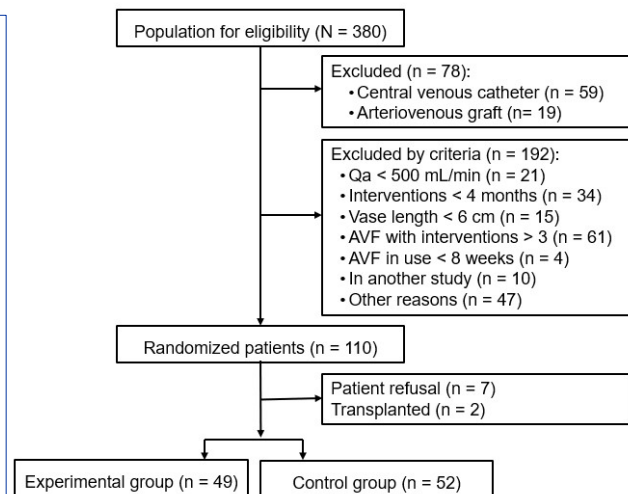


I början av förra året så avslutade vi en ny studie där patienterna hade använt sina fistlar innan studien startade.

Denna studie godkändes och vi publicerade protokollet och följde alla obligatoriska registreringar.

MuST Study II - Methods

- Randomized controlled trial: multicenter study, prospective, non-blind, parallel-group;
- Participants were recruited in 3 private dialysis clinics
- MuST intervention group VS RL control group;
- Patients were randomized 1:1;
- Follow-up period was 12 months;
- Were included 49 patients in MuST group and 52 in RL



Flowchart with the eligible patient's selection for the study

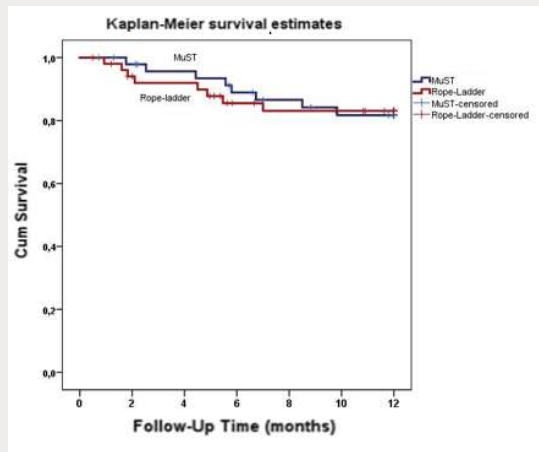
Den här studien hade ett liknande upplägg som den föregående men vi jämförde bara MuST och ropeladder.

Vi utförde studien på tre dialysenheter. Mer än 60 sjuksköterskor deltog. Innan studien började utbildades samtliga deltagare.

Vi inkluderade 101 patienter som lottades till de två grupperna

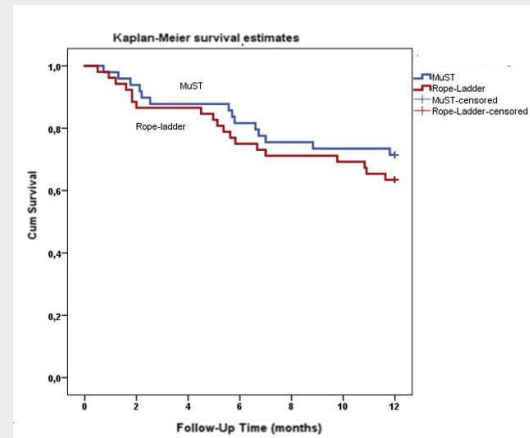
MuST Study II - Results

AVF - Unassisted Patency



Log rank test $p = 0,976$; Breslow $p = 0,826$; Tarone-Ware $p = 0,900$

AVF - Assisted Patency



Log rank test $p = 0,349$; Breslow $p = 0,318$ e Tarone-Ware $p = 0,332$

Studie II visade också att det inte var någon statistisk skillnad mellan grupperna över tid, varken i primära eller sekundära utfall. Inga lokala infektioner eller sepsis observerades.

MuST Study II - Results

Frequency of secondary outcomes between the two groups

Secondary outcomes	MuST N = 49	Rope-ladder N = 52
Hematomas/infiltrations	7	8
Development of previous aneurysms	5	12
New aneurysms	0	4
Time to hemostasis > 10 min	5	1
Bleeding around the needle	5	0
Local signs of infection	0	0
Bacteremia	0	0

- Fistula complications of hematoma/infiltration rate was 15 episodes (0.04/1000 AVF-days) in both groups;
- Hematomas with RL use occurred most frequently at the last "step" (cannulation spot);
- We observed a high rate of aneurysms in the selected patients, 71 (70.30%), 17 continued to develop and four patients developed new aneurysms;
- A higher rate of development previous aneurysms and new aneurysms was observed, associated with RL

Studie II visade också att det inte var någon statistisk skillnad mellan grupperna över tid, varken i primära eller sekundära utfall. Inga lokala infektioner eller sepsis observerades.

Vi observerade även ökad tid för hemostas efter att nålarna dragits samt fler läckage längs nålen i de som stacks med MuST. Dessa patienter remiterades dock till duplex där stenosis identifierades proximalt i AV-fisteln.

MuST Study II - Results

Frequency of secondary outcomes between the two groups: Pain

Cannulation techniques	Before the intervention	At 6 months	At 12 months	<i>p value</i>
MuST, mean (SD)	4.45 (1.66)	4.11 (1.43)	3.67 (1.59)	= 0.061
Rope-ladder, mean (SD)	4.04 (1.86)	3.77 (1.75)	3.52 (2.05)	= 0.307

- The pain score decreased during the study follow-up in both groups, however the difference was not significant (MuST group: $t_{(35)} = 1.93$, $p = 0.061$ versus RL group: $t_{(32)} = 1.04$; $p = 0.307$);
- There were also no differences between the two groups at the end of the study ($t_{(67)} = 0.35$, $p = 0.731$), however, two patients abandoned RL due to cannulation-related pain.

Smärtan skattades som avtagande i båda grupperna, skillnaden var dock inte statistiskt säkerställd. Två patienter i ropeladdergruppen valde dock att byta stickteknik och deltagandet i studien pga smärta

Successful and Safe Cannulation Technique



A: MuST at the beginning of the cannulation after 4 weeks.

B: After 18 months of use.

C: After 3 years.

D: After 5 years of use.

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Här syns ett exempel på lyckad användning av MuST över flera år i en proximal AV-fistel utan bildande av aneurysm

Successful Cannulation Technique

MuST cannulation technique in the same patient in 10 years

- Example of MuST in the same patient in 10 years
- Very easy to implement and maintain.



Picture source: NephroCare Portugal SA database

Jag skulle vilja visa er ett annat lyckat exempel. Här har vi en patient som använt MuST under 10 år, sedan första studien, utan aneurysm.

MuST Implementation in Portugal



NephroCare Portugal
41 Clinics & HHD

76% Clinics with MuST

19% Patients with MuST

4 Clinics with $\geq 90\%$ Patients with MuST

📍 Clinics with MuST
📍 Clinics without MuST



Swedish Access Meeting, November 13-14, 2025

MuST: Multiple Single Canulation Technique | Ricardo Peralta | Portugal

MuST | João Fazendeiro

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I vårt nätverk har vi implementerat MuST på 31 kliniker, totalt 539 sjuksköterskor och 677 patienter

Implementation in Clinics abroad



Visit to the Viseu Clinic

- The first step has been the presentation of the MuST results
- Face to face training with visit to the Clinic
- Meeting to discuss the work implementation
- Share the documentation



Implementation in Clinics abroad:

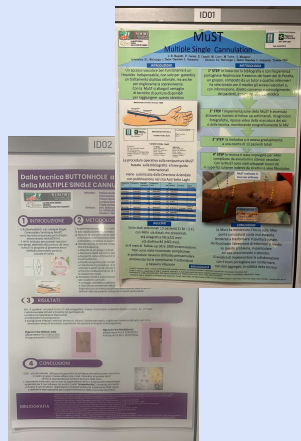
- Refresh the training before implementation;
- Carry out training for nurses at MuST before starting the MuST project;
- Select a minimum of 6/10 patients from each Clinic to start the project. Discuss which shift or shifts.
- Weekly/Monthly meetings

Vi har lärt upp sjuksköterskor i Spanien och Italien som en del i projektet.

Studies published abroad



SIAN - Italy Congresso Nazionale



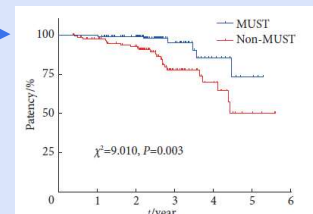
China Must in arteriovenous graft

Multiple Single Cannulation Technique Improves the Outcomes of Arteriovenous Graft in Hemodialysis Patients: A Retrospective Study WANG Raimin, WANG Siyan, XUE Xiaoling, YUE Xiaohong, WANG Xinfang, WANG Pei, LIANG Xianhui[△], Blood Purification Center, The First Affiliated Hospital of Zhengzhou University, Zhengzhou 450052, China
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图1 AVG多单点穿刺技术 (MUST) 示例
Fig 1 Example of AVG multiple single cannulation technique (MUST)

A. A MUST plus was designed for a subject. A total of 9 puncture points were subsequently made in the arterial puncture area of the AVG, which were used for cannulation in rotation in the order of from the bottom one to the top one. The latest cannulation site was the fourth point (enlarged in Fig B). B. Healing status on the first day after puncture. C. Healing status on the 1st day after puncture. D. Healing on the 5th day after puncture. E. Healing after 1 week after puncture. F. Healing after 2 weeks after puncture.



Några studier har publicerats av andra och publicerats på internatinella konferanser. En studie, från Kina, implementerade MuST på AV-graft. Resultatet beskrevs som lyckat då AV-grafen som stacks med MuST hade högre överlevnad än de som stacks med annan teknik.

Studies published abroad																																												
<i>Hemodialysis International</i> ORIGINAL ARTICLE Multiple Single Cannulation Technique for Puncturing Arteriovenous Fistulas: Randomized Comparison With Rope Ladder Technique Cannulation Fang Xu Jun Qiu Shanshan Huo Hailian Bai Xia Wang Peng Shu The Central Hospital of Wuhan, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China																																												
TABLE 2 Comparison of AV fistula-related complications between the two groups of patients. <table> <tr> <th></th><th>Experimental group (n=58)</th><th>Control group (n=59)</th><th>χ^2</th><th>P</th></tr> <tr> <td>Aneurysms (%)</td><td>2 (3.44)</td><td>9 (15.3)</td><td>4.79</td><td>0.029</td></tr> <tr> <td>Stenosis (%)</td><td>1 (1.72)</td><td>7 (11.9)</td><td>4.72</td><td>0.030</td></tr> <tr> <td>Infiltration (%)</td><td>11 (19.0)</td><td>4 (6.76)</td><td>3.89</td><td>0.049</td></tr> <tr> <td>Thrombosis (%)</td><td>1 (1.72)</td><td>8 (13.6)</td><td>5.77</td><td>0.016</td></tr> <tr> <td>Pain scores</td><td>1.82 ± 0.93</td><td>3.29 ± 0.77</td><td>9.41</td><td><0.001</td></tr> <tr> <td>Cannulation difficulty</td><td>1.41 ± 0.54</td><td>2.24 ± 1.04</td><td>5.32</td><td><0.001</td></tr> <tr> <td>Cannulation success rate (%)</td><td>8307 (99.5)</td><td>8409 (99.0)</td><td>12.8</td><td><0.001</td></tr> </table>						Experimental group (n=58)	Control group (n=59)	χ^2	P	Aneurysms (%)	2 (3.44)	9 (15.3)	4.79	0.029	Stenosis (%)	1 (1.72)	7 (11.9)	4.72	0.030	Infiltration (%)	11 (19.0)	4 (6.76)	3.89	0.049	Thrombosis (%)	1 (1.72)	8 (13.6)	5.77	0.016	Pain scores	1.82 ± 0.93	3.29 ± 0.77	9.41	<0.001	Cannulation difficulty	1.41 ± 0.54	2.24 ± 1.04	5.32	<0.001	Cannulation success rate (%)	8307 (99.5)	8409 (99.0)	12.8	<0.001
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Conclusions: - Significant reduction the number of: - Aneurysms, - Stenosis, - Thrombosis, - Pain Scores, - Cannulation difficulty. - MuST was associated with increased infiltrations.																																												
Swedish Access Meeting, November 13–14, 2025 MuST: Multiple Single Cannulation Technique Ricardo Pereira Portugal Page 29																																												

En kinesisk studie drog slutsatsen: Signifikant färre aneurysm, stenoser, tromboser, smärta och sticksvårigheter. MuST förknippades dock med fler läckage längs nålen.

Enligt Xu et al orsakas det ökade läckaget längs nålen vid MuST på upprepade stick på samma plats vilket kan leda till förtunning av subkutan vävnad och hudens slapphet samt att stickhålet ökar i storlek. Dessa delar kan alla leda till att blod kan läcka ut längs nålen både från kärlet och från dialysslangarna.

Xu et al:s definition av infiltration: *infiltration was defined as the leakage of blood along the cannulation needle during dialysis. (Infiltration defineras som läckage längs nålen under dialys)*

Xu et al:s förklaring till detta: *This may be due to repeated cannulation at fixed sites, which can lead to thinning of subcutaneous tissue, skin laxity, and site enlargement. These changes may facilitate blood leakage along the needle track and from the dialysis circuit, increasing the likelihood of infiltration. (Detta kan orsakas av upprepade stick på samma plats, vilket kan leda till förtunning av subkutan vävnad och hudens elasticitet samt hålförstoring. Dessa förändringar kan leda till läckage längs nålen och från dialysslangarna vilket ökar risken för infiltration)*

Conclusions/Application to Practice

- MuST showed similar AVF survival to RL*.
- No significant differences were observed in hematomas or thrombosis rates and no local inflammatory or infectious signs or bacteremia were identified.
- The lower incidence in the **development and new aneurysms** formation in MuST, may prove to be a differentiating factor for patient safety and well-being when deciding between which CT to select.
- The results of this studies suggest that **MuST** might be an **applicable and reliable CT for self-cannulation** and **can be adapted** for patients undergoing dialysis more than 3 times a week.



* The RL technique during the study was with a personalized diagram

- MuST visar på liknande överlevnad som RL
- Ingen signifikant skillnad syntes i antal komplikationer och dysfunktion mellan RL och MuST
- MuST kan anpassas efter patienter som har dialys 4 gånger per vecka.
- Den minskade bildningen och utvecklingen av aneurysm vid MuST kan vara en avgörande faktor, med hänvisning till, patientens säkerhet och välmående, valet av stickteknik.

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