

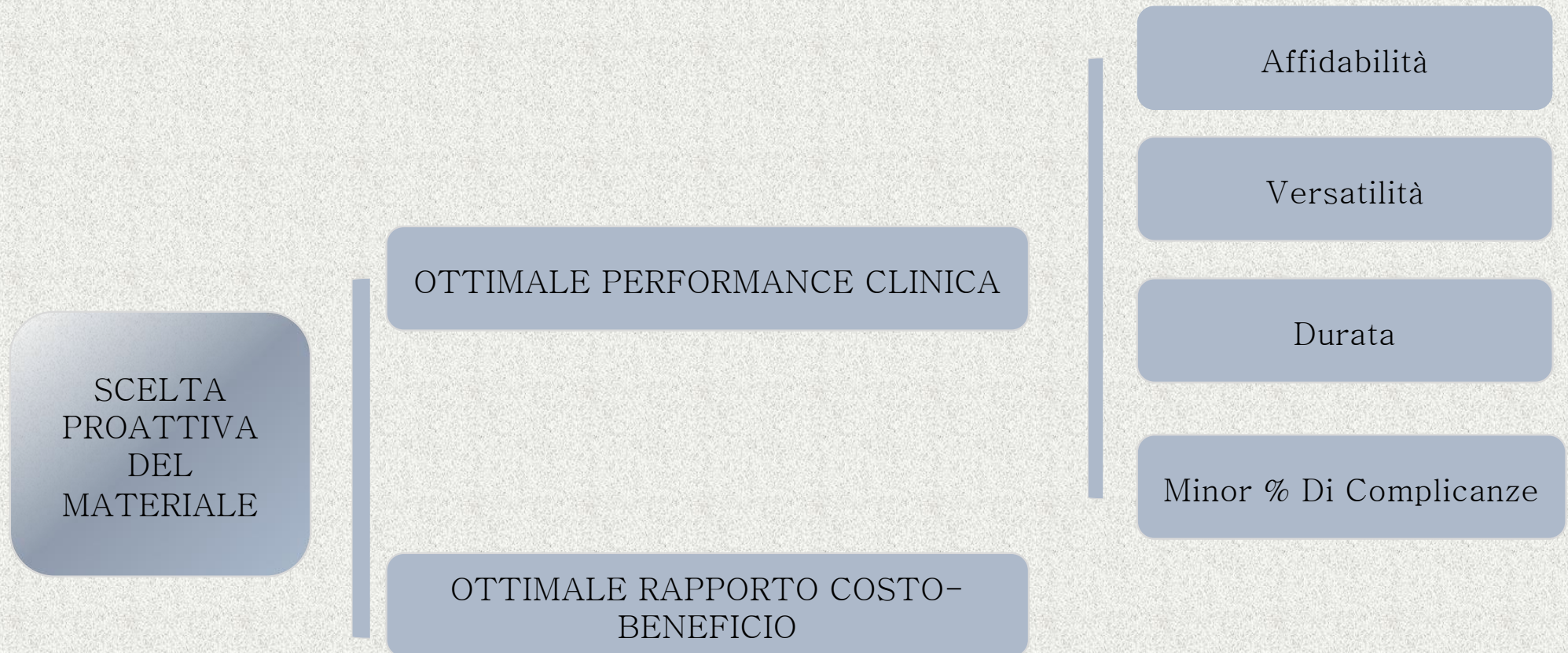
Come evitare lesioni meccaniche: la scelta del materiale

VI Convegno nazionale GAVePeD Bologna



Dott.ssa Zanaboni Clelia Direttore SS Anestesia e Rianimazione Pediatrica Azienda Ospedaliera Universitaria Parma

SCELTA DEL CATETERE IDEALE



PERFORMANCE CLINICA DEL CATETERE



PERFORMANCE CLINICA
OTTIMALE

Materiale Resistente e Duraturo

Facile da Impiantare

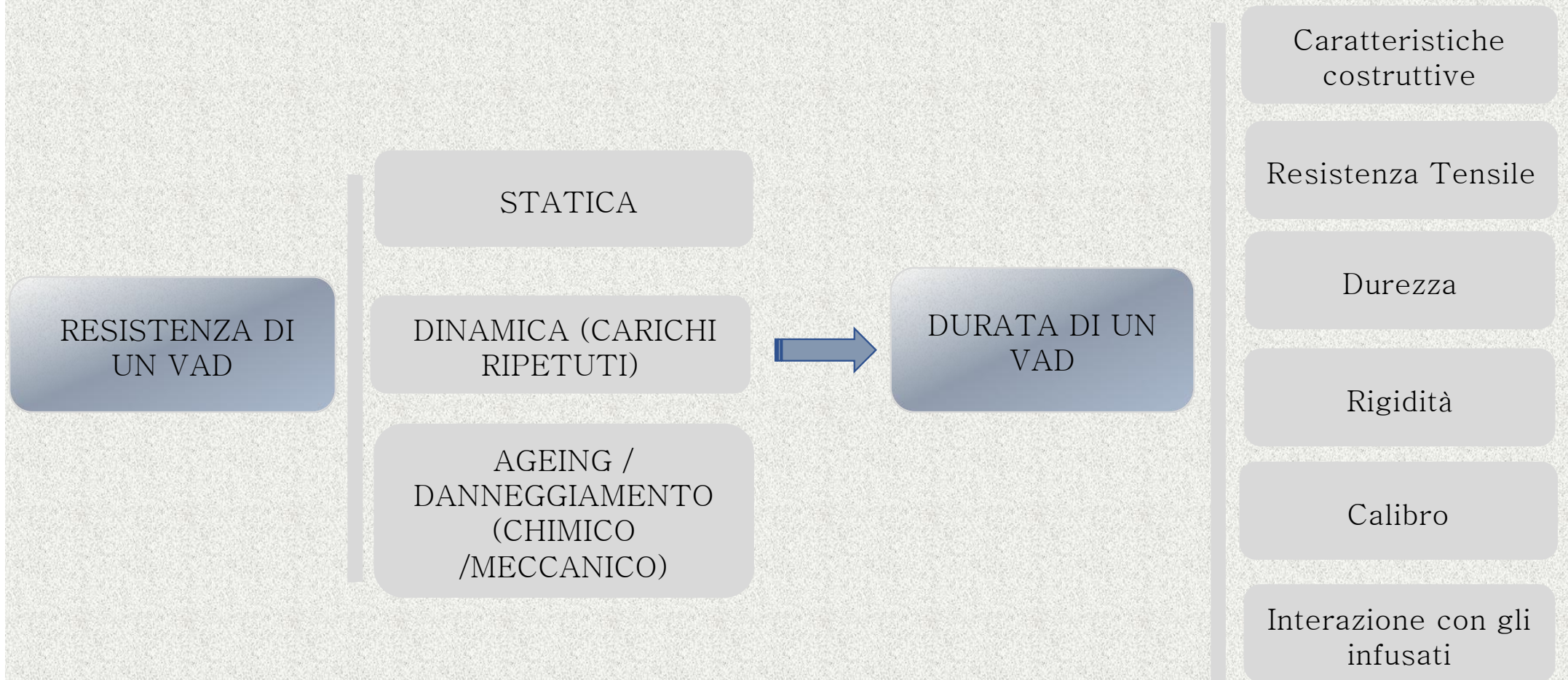
Che permanga con il < numero di
Complicanze

Che non richieda sostituzioni
durante il percorso terapeutico

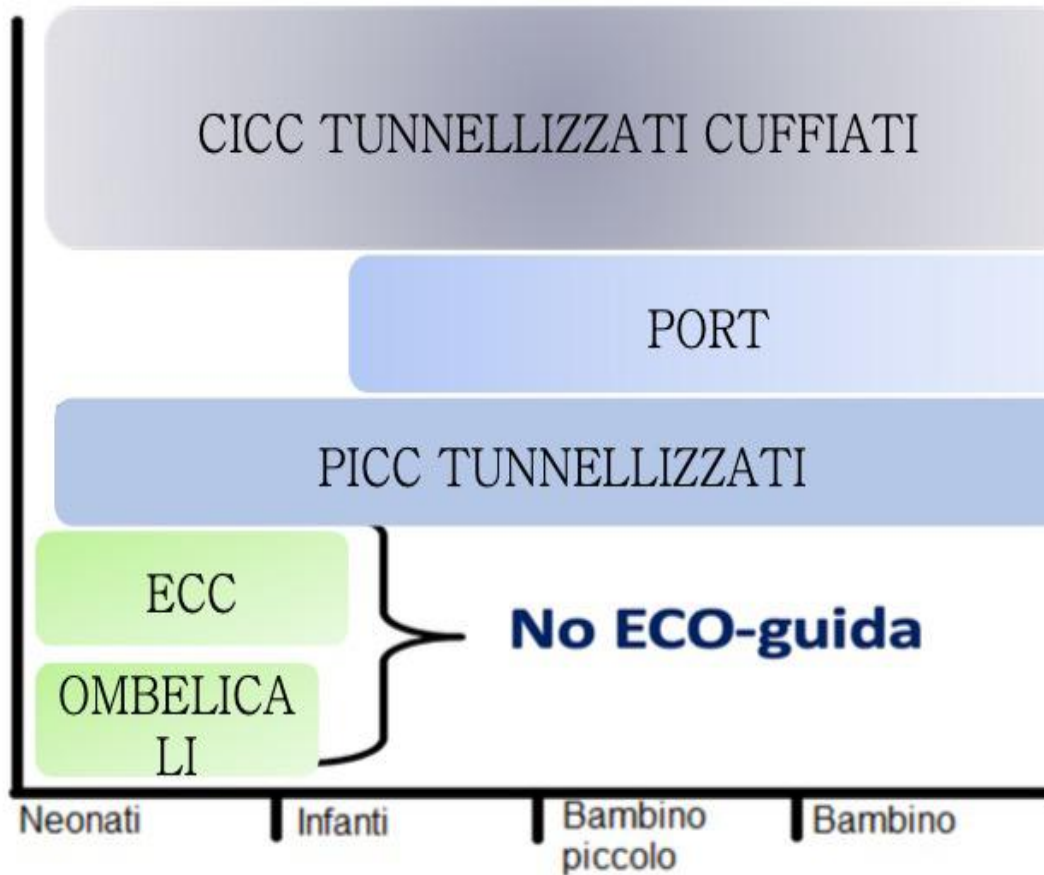
Che possa essere utilizzato con i
Power Injector Radiologici

Facile da rimuovere

STABILITÀ E DURATA



CATETERI A LUNGA PERMANENZA



Long term (tunneled, cuffed external VADs)				
	Material	Tip	Lumen	French
Broviac	Silicon	No valve	1	2.7, 4.2, 6.6, 7, 9.6
Hickman	Silicon	No valve	2	7, 12
Leonard	Silicon	No valve	2	10
Groshong	Silicon	Distal valve	1 or 2	5.5, 7, 8, 9
ProLine	P.I. PUR	No valve	1 or 2	5, 6

Silicon PICC	Silicon	No valve	1 or 2	3, 4, 5
Groshong PICC	Silicon	Distal valve	1 or 2	4, 5
Solo, PASV PICC	P.I. PUR	Proximal valve	1 or 2 or 3	3, 4, 5, 6
PASV PICC	PUR	Proximal valve	1 or 2	4, 5
PUR PICC	PUR	No valve	1 or 2	4, 5
P.I. PUR PICC	P.I. PUR	No valve	1 or 2 or 3	3, 4, 5, 6

CATETERI IN SILICONE

CATETERI IN SILICONE

BASSA INTERAZIONE CON COMPOSTI CHIMICI

MINIMA COMPATTEZZA STRUTTURALE (DIVARIO DI/DE)

MAGGIOR SPESSORE DELLA PARETE A PARITÀ
CALIBRO

RIGIDI E FRAGILI (POROSI)

RESISTENZA ALLA PRESSIONE

SENSIBILITA' VERSO I SOLI

SI DENATURANO CON GLI ANNI

TENDENZA AL KINGING

PROBABILE ROTURA DURANTE LA RIMOZIONE

FISSAGGIO: NON UTILIZZABILE SAS

FRAGILE



CATETERI IN POLIURETANO POWER

CATETERI IN POLIURETANO POWER

RESISTENZA ALLA TENSIONE E AI CARICHI DI ROTTURA DEL CATETERE E DELLE CONNESSIONI

> RESISTENZA ALLE SOLLECITAZIONI PRESSORIE ENDOLUMINALI (300 PSI)

FLUSSI ELEVATI 5ml/s A PARITA' DI INGOMBRO

MINOR SPESSORE PARIETALE

MINOR ATTRITO ENDOTELIALE

MIGLIOR GESTIONE DELLE COMPLICANZE OCCLUSIVE

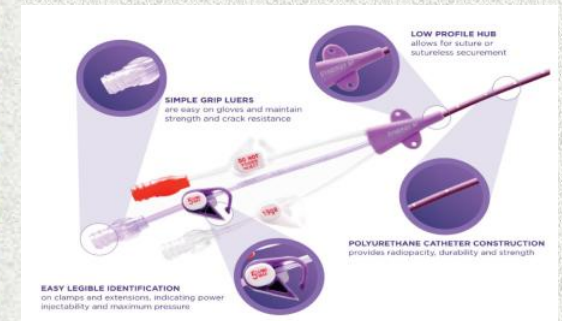
COMPORTAMENTO VISCO-ELASTICO A 37°

POCA INTERFERENZA CON I FARMACI E CHEMIOTERAPICI

NON INTERFERENZA CON DISINFETTANTI SU BASE ALCOLICA

NON SI DENATURANO CON GLI ANNI

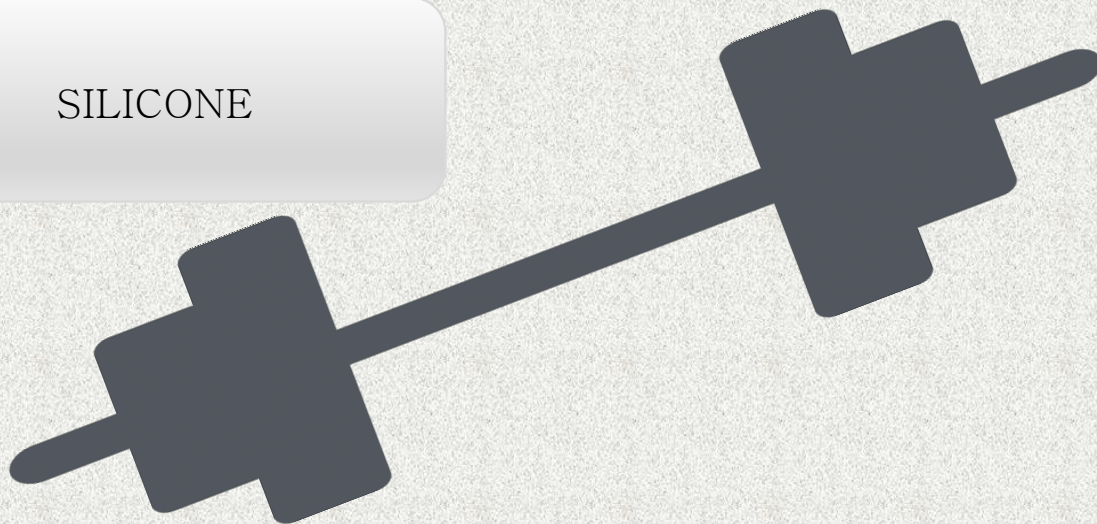
FISSAGGIO CON SAS E COLLA



SIL VS PUR PROPRIETÀ MECCANICHE

SILICONE

POLIURETANO POWER
INJECTABLE



> Forza Tensile

> Resistenza allo
scoppio

> Flussi

> Resistenza al
Kinking

> Disostruibilità

SIL VS PUR COMPATIBILITA'

SILICONE

POLIURETANO POWER
INJECTABLE

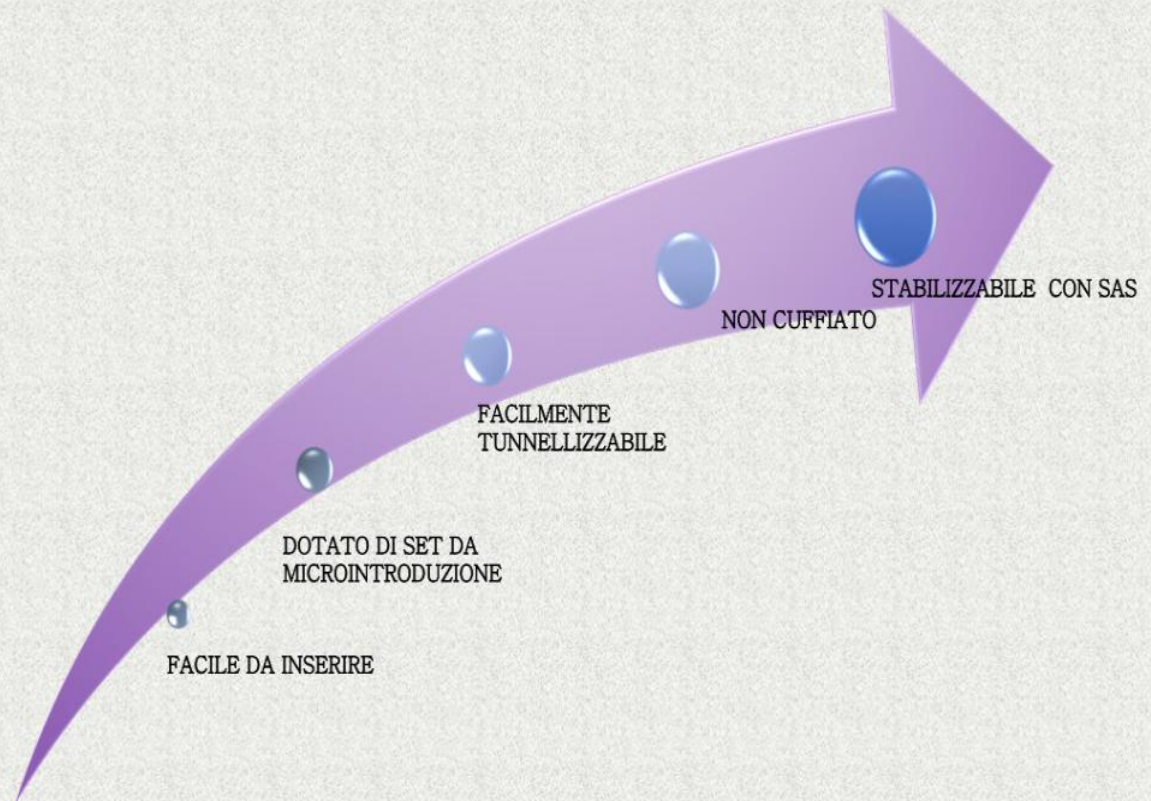
Solventi

Etanolo

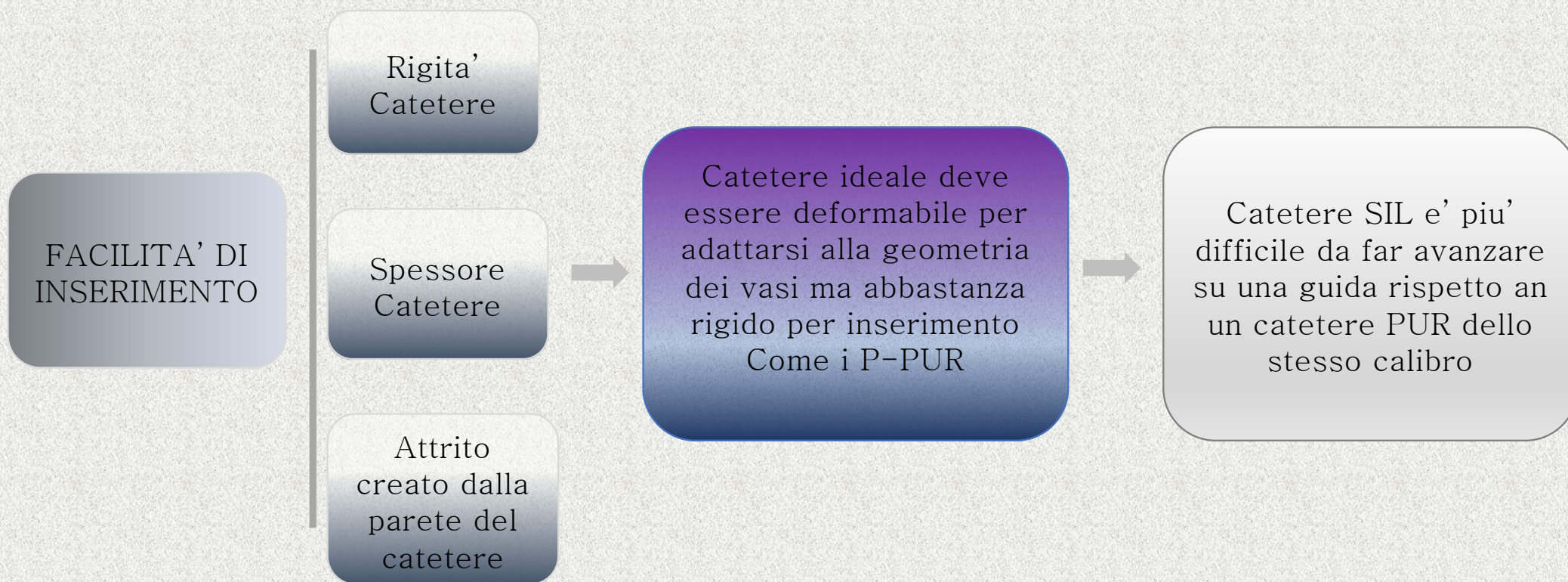
Chemioterapici



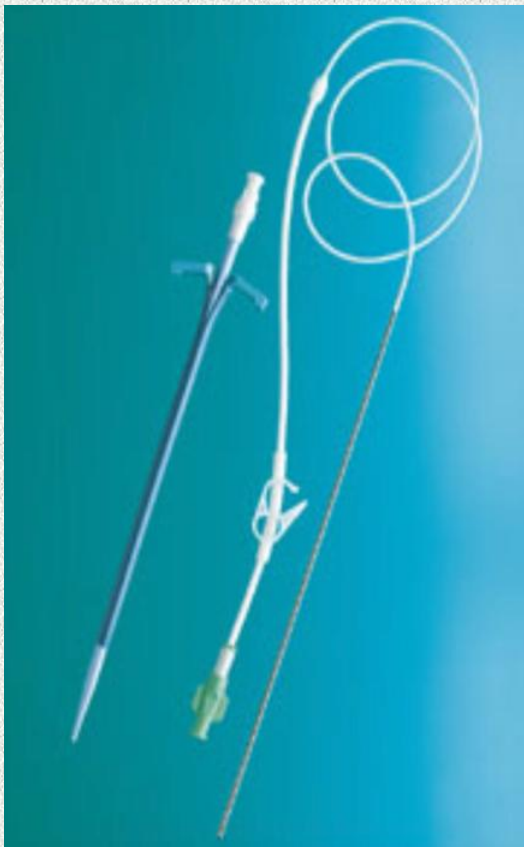
IL CATETERE IDEALE ALL'INSERZIONE



FACILITÀ DI INSERIMENTO



SET DA MICROINTRODUZIONE



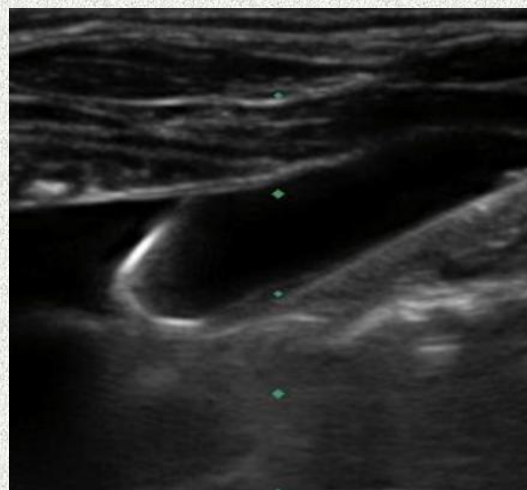
15 cm



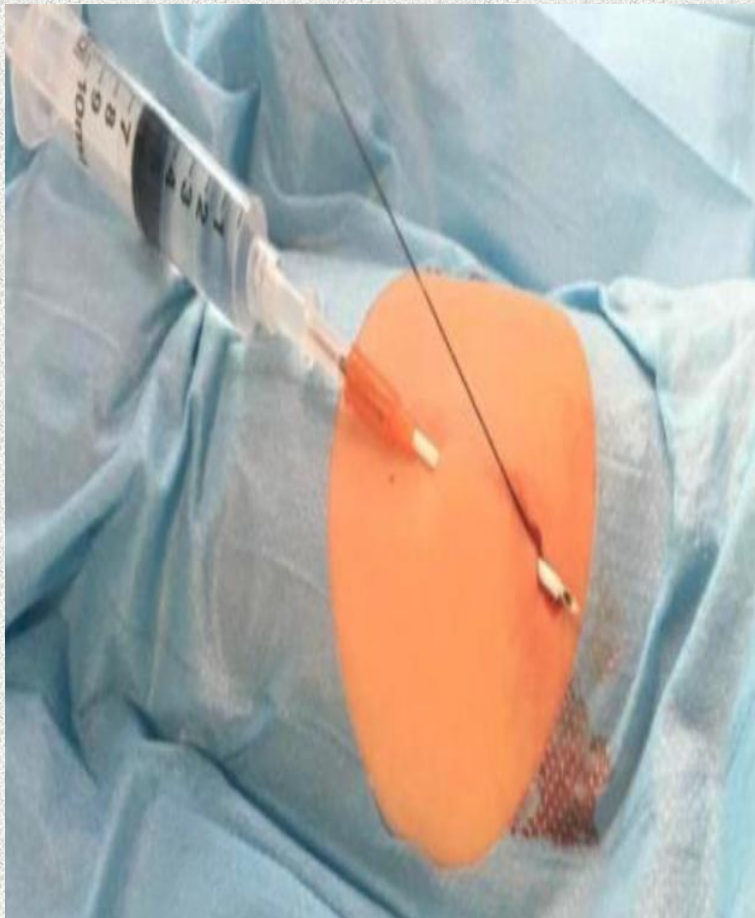
5 cm



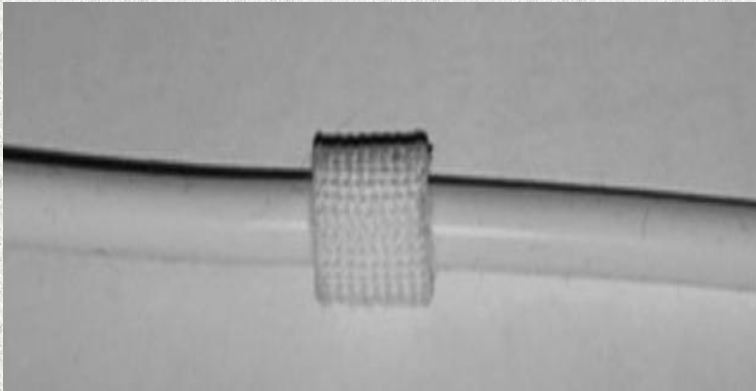
LA SCELTA DELLA GUIDA



IL VANTAGGIO DELLA TUNNELLIZZAZIONE



CUFFIA VANTAGGIO o SVANTAGGIO?



STABILIZZAZIONE CON SAS



Original research article

JVA | The Journal of Vascular Access

The Journal of Vascular Access
1-10
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DOI: 10.1177/1129729820924568
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SAGE

GAVeCeLT-WoCoVA Consensus on subcutaneously anchored securement devices for the securement of venous catheters: Current evidence and recommendations for future research

Fulvio Pinelli¹, Mauro Pittiruti², Ton Van Boxtel³, Giovanni Barone⁴, Roberto Biffi⁵, Giuseppe Capozzoli⁶, Alessandro Crocoli⁷, Stefano Elli⁸, Daniele Elisei⁹, Adam Fabiani¹⁰, Cristina Garrino¹¹, Ugo Graziano¹², Luca Montagnani¹³, Alessio Pini Prato¹⁴, Giancarlo Scoppettuolo¹⁵, Nicola Zadra¹⁶, Clelia Zanaboni¹⁷, Pietro Zerla¹⁸, Evangelos Konstantinou¹⁹, Matt Jones²⁰, Hervé Rosay²¹, Liz Simcock²², Marguerite Stas²³ and Gilda Pepe¹⁵



COMPATIBILITA' CON COLLA IN CIANOACRILATO

JVA
ISSN 1129-7298

ORIGINAL RESEARCH ARTICLE

Experimental study on the chemico-physical interaction between a two-component cyanoacrylate glue and the material of PICCs

Francesca Di Puccio¹, Daniela Giacomarro¹, Lorenza Mattei¹, Mauro Pittiruti², Giancarlo Scoppettuolo²

¹ Dipartimento di Ingegneria Civile e Industriale, Università di Pisa, Pisa - Italy
² Fondazione Policlinico Universitario "A. Gemelli", Roma - Italy

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DOI: 10.5301/jva.5000816

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SAGE

ABSTRACT

Introduction: The use of cyanoacrylate glue as sealant on the exit site of peripherally inserted central catheters (PICCs) may offer some important clinical advantages. However, concerns exist about the potential interaction between cyanoacrylate and the material of the catheter itself. The aim of this study was to investigate the possibility of damage to the catheter secondary to a long-term contact with a two-component skin glue (N-butyl + octyl cyanoacrylate).

Methods: Twelve PICCs of different brands and types were selected (11 made of polyurethane and one made of silicon). PICCs were glued onto artificial skin pads, slightly wetted with Earle solution. The pads were kept in an egg incubator at 34°C and 60% humidity, for up to twelve weeks. Possible signs of degradation were monitored by surface analyses and mechanical tests. Scanning electron microscopy observations, surface roughness measurements, pressure strength and uniaxial tests were performed.

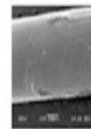
Results: Samples were analyzed after 4, 8 and 12 weeks of contact with the glue. No chemical reaction between the glue and the material of the catheters was evident. The mechanical strength of PICCs was consistently within the ranges of ISO standards. An expected increase in the stiffness of the samples covered with glue was observed in uniaxial tests. The silicon catheter was weaker than the polyurethane catheters and was damaged while trying to remove it from the pad for tests.

Conclusions: The long-term use of N-butyl + octyl cyanoacrylate glue on polyurethane PICCs is not expected to be associated to any damage to the catheter.

Surface analyses



Optical microscope (OM)



Scanning electron microscope (SEM)



3D rugosimetry

Mechanical tests

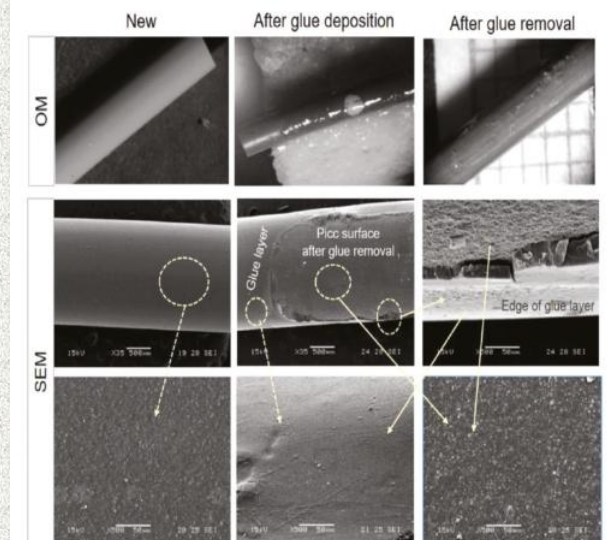


Uniaxial tensile tests:

- Slow → stiffness
(0.1 min⁻¹ up to 20%)

- Fast → strength
(20 min⁻¹ up to 10 N)

Pressure tests (up to 200 psi)



PERFORMANCE DEL CATETERE IN SITU



Flussi adeguati

Facilmente disostruibile

Non soggetto a rotture

Compatibile con l'infusato

Compatibile con i solventi

Duraturo

FLUSSI ADEGUATI

< FORZA TENSILE

< RESISTENZA ALLO SCOPPIO

A PARITA' DI CALIBRO I
CATETERI IN PUR HANNO
UN LUME MAGGIORE ED UN
FLUSSO MAGGIORE
RISPETTO A QUELLI IN SIL

PARETE INSPESSITA
PER FORNIRE
ADEGUATA FORZA



VANTAGGIO DEI CATETERI POWER INJECTABLE

CONNESSIONI PARTICOLARMENTE RESISTENTI

1. BAMBINI CHE ESEGUONO DIVERSE STADIAZIONI TAC/RM DURANTE IL PERCORSO TERAPEUTICO: RESISTENZA AGLI ALTI FLUSSI (POWER INJECTORS RADIOLOGICI)

2. BAMBINI CHE DEVONO ESEGUIRE PROTOCOLLI TERAPEUTICI AD ALTI FLUSSI RESISTENZA ALLA PRESSIONE 300 *PSI* E FLUSSI 5ML/S



FACILIMENTE DISOSTRUIBILE

Non vi sono differenze tra SIL e PUR in termini di occlusione.

Il P-PUR ha il vantaggio : **DISOSTRUZIONE PIÙ FACILE**

COMPOSIZIONE
INFUSATI

FORMAZIONE DI
PRECIPITATI

SOMMINISTRAZIONE
DI SOSTANZE
INCOMPATIBILI



A PARITÀ DI CALIBRO IL
PUR HA UN DIAMETRO
INTERNO MAGGIORE E
RESISTE AD ALTE
PRESSIONI DI
CONSEGUENZA POTRÀ
ESSERE DISOSTRUITO PIÙ
FACILMENTE

COMPATIBILITA' CON SOLVENTI

*MISURA DELLA CAPACITÀ DI UN MATERIALE A
MANTENERE LE SUE PROPRIETÀ QUANDO
ESPOSTO A PRODOTTI CHIMICI*

I CATETERI NON SONO ATTACCATI DAI FARMACI MA DAI SOLVENTI NECESSARI A METTERLI IN SOLUZIONI STABILI NEL TEMPO CAPACI DI PRESERVARLI

IL SILICONE È RESISTENTE AI SOLVENTI IN GENERE GRAZIE AI LEGAMI CROCIATI MA CEDE PIÙ FACILMENTE. I CATETERI IN SILICONE SI GONFIANO MA NON SI ROMPONO A CONTATTO CON LA MAGGIOR PARTE DEI SOLVENTI.

E IL POLIURETANO????

CLASSIFICAZIONE DEI POLIURETANI

PUR : termine generico inteso per polimeri che contengono una minoranza di gruppi funzionali uretanici.

Prima Generazione:
Polieter-uretani



Aromatici: Pellethane

Seconda Generazione:
Poliester-uretani



Alifatici: Tecoflex

Terza generazione:
Policarbonati uretani



Alifatici: Chronoflex
Carbotani

LA LETTERATURA NON È ATTENTA QUANDO SI PARLA DI “POLIURETANI”.
LA MAGGIOR PARTE DEI LAVORI NON SPECIFICA CHIARAMENTE QUALE
“POLIURETANO” HA TESTATO, CREANDO CONFUSIONE SU QUESTI POLIMERI.

POLIURETANO E ETANOLO

Vol. 26 No. 8 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY

1

THE EFFECTS OF PROLONGED ETHANOL EXPOSURE ON THE MECHANICAL PROPERTIES OF POLYURETHANE AND SILICONE CATHETERS USED FOR INTRAVASCULAR ACCESS

Christopher J. Crnich; Jeremy A. Halfmann; Wendy C. Crone; Dennis G. Maki

RESULTS: No significant differences between exposed and unexposed catheters were identified for any of the mechanical parameters tested except for a marginal reduction in the modulus of elasticity for both polyetherurethane and silicone catheters and minor increases in the wall area of polyetherurethane catheters.

Se è vero che teoricamente i poliuretani sono più sensibili del silicone all'effetto dell'alcool, effettivi danni ai cateteri non sono mai stati dimostrati, nè *in vivo* nè in studi ben condotti *in vitro*

Anaesth Intensive Care 1997; 25: 350-353

Polyurethane Central Venous Catheters, Hydrochloric Acid and 70% Ethanol: A Safety Evaluation

G. J. McHUGH*, D. J. C. WILD†, J. H. HAVILL‡

Intensive Care Unit, Waikato Hospital and Waikato Microscope Unit, Ruakura Research Centre, Hamilton, New Zealand

LONG TERM POLYURETHANE CATHETER ALCOHOL COMPATIBILITY I. PHYSICAL AND RHEOLOGICAL STUDIES

Lecon Woo¹, John Wesley MD², Maryellen Zibell², Christopher Gardner² and William Anderson²
¹LWoo Associates LLC, Libertyville IL 60048
²Excelsior Medical, Neptune, NJ

Abstract

Thermoplastic urethanes (TPU) offer broad property range, processing flexibility, and biocompatibility for medical applications. Alcohol based disinfectants have a long history of effective and safe use. Expanding on earlier rheology molecular weight data indicating minimal reduction, we conducted a long term compatibility study covering all known urethane types in a hemo-dialysis setting with a simulated clinical exposure protocol for 90 days. After 90 days exposure, minor changes in physical properties on the catheter body and components were detected, often similar to the saline control. Most importantly, resultant properties far exceeded ISO requirements for catheters.

Introduction

TPU catheters are prominent in device applications and increasingly, they are subjected to longer duration use, and exposed to a wide variety of chemically active agents. Alcohol based disinfectants are the most widely used for its long history of safety and effectiveness. To understand the compatibility of polyurethane devices and alcohol exposure, we conducted both fundamental material response and device performance studies. For example, it was pointed out in our earlier studies (1,2), that due to TPU's complex annealing behavior, vastly different properties can result from

components and connections exposed to the alcoholic disinfectant were studied.

Experimental

Continuing our previous studies where more detailed procedures are fully described, we evaluated hydrolytic molecular weight degradation upon exposure to alcoholic disinfectants with melt rheology with the well established relationship for linear polymers (4-5),

$$\eta = K \cdot Mw^{3.4} \quad (1)$$

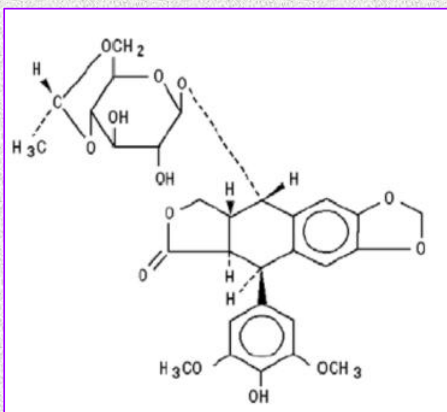
Where η is the steady shear limiting viscosity
 Mw is the weight average molecular weight

Five TPU based hemo-dialysis long term indwelling catheters chosen to cover all known commercial polyurethane types were studied. They included (A) Tecoflex®, (B) Tecothane®, (C) Carbothane®, (D) Pellethane®, and (E) Chronoflex® (6-10). Sample A uses an aliphatic polyurethane with ether soft segments. Samples B and E are ether soft segment aromatic polyurethanes, Sample C contains a polycarbonate soft segment and Sample E's soft segment is also polycarbonate based but differs from C. These catheters range in size from 10 Fr to 14.5 Fr and from 24 to 55 cm in length. Figure 1 describes a locations indicated.

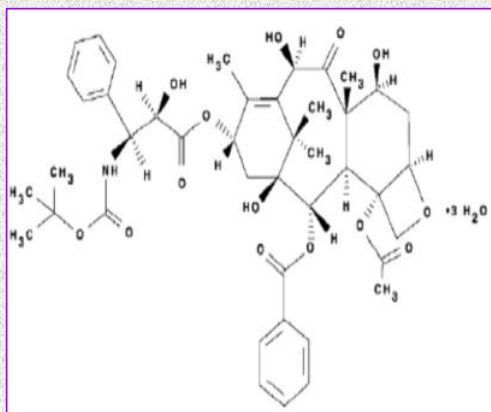
POLIURETANO E CHEMIOTERAPICI

È STATO SEGNALATO CHE I CATETERI IN "POLIURETANO" SI "DEGRADANO" E "SI ROMPONO" SE ESPOSTI A SOLUZIONI DI AGENTI CHEMIOTERAPICI COME ETOPOSIDE, TAXOLO E TAXOTERE.

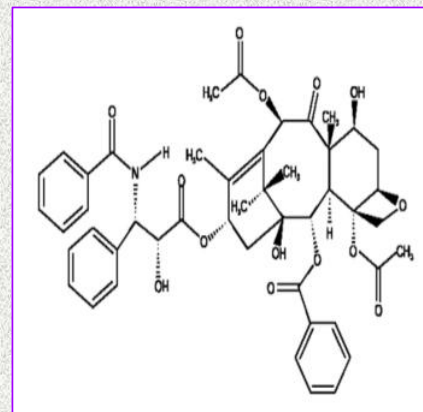
QUESTI FARMACI VENGONO MISCELATI CON TRASPORTATORI CHIMICI CHE CONTENGONO ELEVATE PROPORZIONI DI ETANOLO O PREPARATI IN UNA SOLUZIONE CONCENTRATA.



Etoposide



Taxotere



Taxolo

POLIURETANO E CHEMIOTERAPICI

I poliuretani di terza generazione (es. Carbothane), ovvero quelli utilizzati per i PICC power injectable sono resistenti all'alcool

Vol. 26 No. 8 INFECTION CONTROL AND HOSPITAL EPIDEMIOLOGY 1

THE EFFECTS OF PROLONGED ETHANOL EXPOSURE ON THE MECHANICAL PROPERTIES OF POLYURETHANE AND SILICONE CATHETERS USED FOR INTRAVASCULAR ACCESS

Christopher J. Crnich; Jeremy A. Halfmann; Wendy C. Crone; Dennis G. Maki

ABSTRACT

BACKGROUND: Products containing alcohol are commonly used with intravascular devices at insertion, to remove lipids from occluded intravascular devices used during parenteral nutrition, and increasingly for the prevention and treatment of intravascular device-related bloodstream infection. The effects of alcohol on the integrity of intravascular devices remain unknown.

METHODS: Two types of widely used commercial peripherally inserted central catheters, one made of polyetherurethane and one made of silicone, were exposed to a 70% ethanol lock solution for up to 10 weeks. Mechanical testing was performed to identify force-at-break, stress, strain, modulus of elasticity, modulus of toughness, and wall area of ethanol-exposed and control catheters.

RESULTS: No significant differences between exposed and unexposed catheters were identified for any of the mechanical parameters tested except for a marginal reduction in the modulus of elasticity for both polyetherurethane and silicone catheters and minor increases in the wall area of polyetherurethane catheters.

CONCLUSIONS: These data indicate that exposure to a 70% ethanol lock solution does not appreciably alter the integrity of selected commercial polyetherurethane and silicone catheters. Given the greatly expanded use of alcoholic solutions with intravascular devices of all types, we believe that manufacturers would be well advised to subject their catheters and other intravascular devices to formal testing of the type employed in this study (*Infect Control Hosp Epidemiol* 2005;26:000-000).

LONG TERM POLYURETHANE CATHETER ALCOHOL COMPATIBILITY I, PHYSICAL AND RHEOLOGICAL STUDIES

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JVA

ISSN 1129-7298

J Vasc Access 2016; 17 (2): 175-181
DOI: 10.5301/jva.5000452

ORIGINAL ARTICLE

A comparative study on the mechanical behavior of polyurethane PICCs

Paolo Poli¹, Antonella Scocca¹, Francesca Di Puccio¹, Giuseppe Gallone¹, Lorenza Angelini², Emanuele Maria Calabrò¹

¹Pain Therapy Unit, S. Chiara Hospital, Pisa - Italy

²Department of Civil and Industrial Engineering, University of Pisa, Pisa - Italy

ABSTRACT

Purpose: This study describes a comparative analysis of eight commercial polyurethane, single-lumen peripherally inserted central venous catheters (PICCs) from different vendors. The aim was to investigate the mechanical response of the catheters providing objective and quantitative data to support a comparison among them. Such data could help nurses and physicians to select a central venous catheter (CVC) not only on the basis of the expected dwell duration or of the assessment of the vessels at the desired insertion site but also of the chemical and mechanical properties of the CVC and of the projected response of the body to these properties.

Methods: An experimental procedure was defined and tests were performed to assess some main characteristics of the PICC lines, including macro and microgeometric features, chemical and physical properties, and mechanical response. Preliminary measurements were performed to accurately define all geometric characteristics, including length, inner and outer diameters, and any inherent initial curvature of the catheter. Micro-geometric features were investigated using surface roughness analysis, optical microscopy, and scanning electron microscopy. Mechanical properties were studied by means of dynamic mechanical thermal analysis, simple uniaxial tensile tests, and kinking tests.

Results: Results are discussed in order to compare the different PICC lines. In particular, they show that polyurethane catheters can have a different mechanical behavior, which might play a role in the onset of pathologic processes and result in an increased risk and incidence of catheter-related complications.

Conclusions: This study provides useful information that can help identifying and facilitate the choice of a PICC.

Keywords: Comparative study, Mechanical properties, PICCs

SIL VS PUR :EVIDENZE IN LETTERATURA

Evidenza scientifica di una esposizione più elevata alle complicanze meccaniche dei cateteri in Silicone:

- dislocazione e rottura
- fissurazione esterna o interna
- frattura/ embolia segmento distale

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Keywords: Comparative study, Mechanical properties, PICCs

The Journal of Vascular Access 2000; 1: 36-39

BIOMATERIALS

Groshong catheters: technical aspects and clinical features

C. CAMPISI, L. CAMILLUCCI¹, A. CAMPOPIANO¹, C. FANIZZA¹, A. SARDONIO

National Research Council - Institute of Biomedical Technologies, Rome - Italy

¹ ISPEL - National Institute for Occupational Prevention and Safety - Monteporzio Catone, Rome - Italy

Groshong PICC and home care: an opportunity. Clinical experience after the first 200 implants

S. SPAZIANI¹, T. MICHELI², B. VINCENZI², C. CAMPISI¹

¹ Rep. Analgesic and Palliative Therapy Unit, ASL Frosinone, Frosinone - Italy

² Biomedical Campus, Rome - Italy

³ National Research Council, Institute of Biomedical Technologies, Rome - Italy

ABSTRACT: Peripherally Inserted Central Catheters (PICC) represent an alternative for critical patient care, and are safer to implant in home patients.

The authors report on their experience with the first 200 4 Fr Groshong PICC implanted during the last 18 months. The procedure can be easily applied at home (98% successful implant rate), without the need for fluoroscopic or ultrasound guidance. Moreover, the authors believe that the X-ray control after implant is not strictly necessary. After 11,570 days/catheters, only 5 devices were explanted because of complications: 4 because of sepsis and peripheral phlebitis, and the last was explanted by another medical staff for unclear reasons. The complications needing no explanation were a total of 32: for 12 of them the external portion of tube was damaged during use, while for the other 20 the internal clots were resolved with forced flushing.

The authors conclude that Groshong PICC can be considered the gold standard for home care management of critical patients, taking into account the quality of pure silicon, the presence of a valve and the specially-made closed-tip.

RISCHIO DI FRATTURA SIL VS PUR

Comparative Study > J Vasc Access. 2016 Nov 2;17(6):535-541. doi: 10.5301/jva.5000606. Epub 2016 Oct 21.

Fracture of totally implanted central venous access devices: a propensity-score-matched comparison of risks for Groshong silicone versus polyurethane catheters

Soichi Kojima¹, Takao Hiraki¹, Hideo Gobara¹, Toshihiro Iguchi¹, Hiroyasu Fujiwara¹, Yusuke Matsui¹, Toshiharu Mitsuhashi², Susumu Kanazawa¹

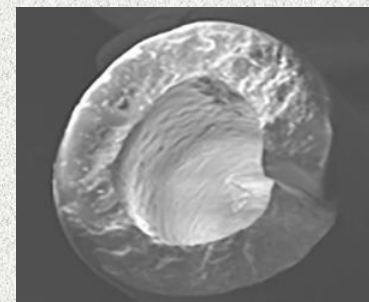
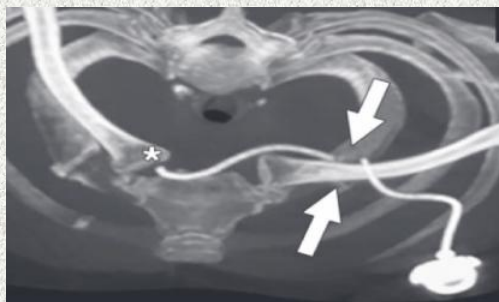
Abstract

Purpose: To evaluate retrospectively the fracture risk of totally implanted venous access devices connected to Groshong silicone (SC) versus polyurethane (PU) catheters, inserted via the internal jugular vein.

Materials and methods: The study population comprised 384 SC and 221 PU central venous catheters implanted via the internal jugular vein. The presence of catheter fracture was evaluated. Variables possibly related to catheter fracture were evaluated. First, in order to determine the factors associated with fracture, fracture rates were compared with the log-rank test between the two groups divided by each of the variables. Then, in order to adjust for potential confounders, propensity-score matching of the variables was employed in the two catheter groups. Finally, the rates of fracture were compared between the two propensity-score-matched catheter groups.

Results: There were 16 cases of catheter fracture, for an overall fracture percentage of 2.6% (16/605). All 16 cases of fracture occurred in the SC catheter group. Smaller patient body mass index ($p = 0.039$), deeper catheter tip position ($p = 0.022$), and SC catheters ($p = 0.019$) were significantly associated with fracture. With the propensity-score-matching method, 180 cases were selected in each catheter group. Comparison of the two propensity-score-matched groups showed that fracture rates for SC catheters remained significantly ($p = 0.018$) higher than those for PU catheters.

Conclusions: Ports connected to Groshong SC catheters - when implanted via the internal jugular vein - posed a higher risk of fracture than did ports connected to PU catheters.



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REVIEW

A comparison of silicone and polyurethane PICC lines and postinsertion complication rates: a systematic review

Tammy Seckold, Sandra Walker, Trudy Dwyer
Central Queensland University, Queensland - Australia

Results: Overall the PICCs complication rates ranged from 8 to 47.9%. While both lines saw similar overall rates upon closer observation the strengths and weaknesses of both lines are shown.

Polyurethane PICC lines were found to provide lower rates of infection, dislodgment, thrombus and rupture complications.

Mixed results were found with catheter line occlusions, overall averages showing polyurethane lines slightly higher rates than silicone. Oncology patients however saw opposite results.



**Cochrane
Library**

Cochrane Database of Systematic Reviews

Peripherally inserted central catheter design and material for reducing catheter failure and complications (Protocol)

Schults JA, Kleidon T, Petsky HL, Stone R, Schoutrop J, Ullman AJ

The primary goal of central vascular access using a PICC is to facilitate the reliable delivery of infusates over a prolonged period, for both in- and outpatient settings. Choice of PICC material and design can play a vital role in preventing or reducing device failure and subsequent reinsertion procedures. Early PICCs were predominately manufactured using silicone-based materials, which were considered soft and 'stretchable' for increased patient comfort and ease of placement ([Gallieni 2008](#)). However, these PICCs had smaller internal lumens, tolerated lower injectable pressures (50 psi) and were associated with an increased risk of fracture and dislodgement ([Poli 2016](#)). Subsequent PICCs were composed of a stronger polyurethane material which tolerated higher pressures (> 100 psi) with only a small decrease in catheter flexibility. However, these first generation polyurethane PICCs were associated with an increased risk of phlebitis and vessel trauma due to the rigidity of the material ([Seckold 2015](#)). Newer polyurethane PICCs are composed of material blends, which soften with body temperature and facilitate injection pressures of up to 300 psi (power injectable), whilst maintaining catheter workability and resilience ([May 2015](#)).

CATETERE IDEALE DURANTE LA RIMOZIONE

Fine trattamento

Infezione non risolta o sepsi

Occlusione non risolvibile

Rottura del catetere

Dislocazione della punta



Rottura

Intrappolamento

Embolizzazione

COMPLICANZE DURANTE LA RIMOZIONE

FRATTURA DEL
CATETERE

INTRAPPOLAMENTO

FRAMMENTI
POSSONO NON
MIGRARE

EMBOLIA DI
PICCOLI
FRAMMENTI
DEL CATETERE

EMBOLIZZAZIONE
DEL CATETERE

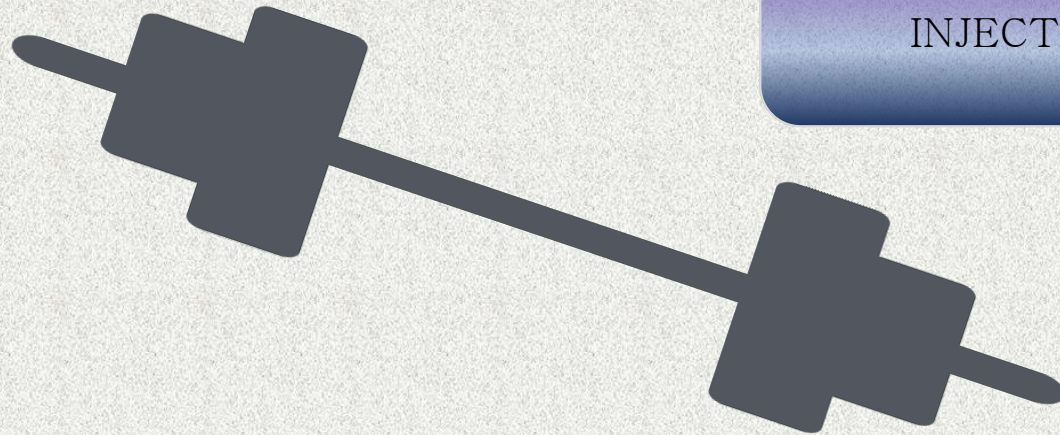
RITENZIONE CRONICA DI
CATETERI O
FRAMMENTI

NECESSARIE PROCEDURE ANGIOGRAFICHE / RIMOZIONE CHIRURGICA

SIL VS PUR ROTTURA E EMBOLIZZAZIONE

SILICONE

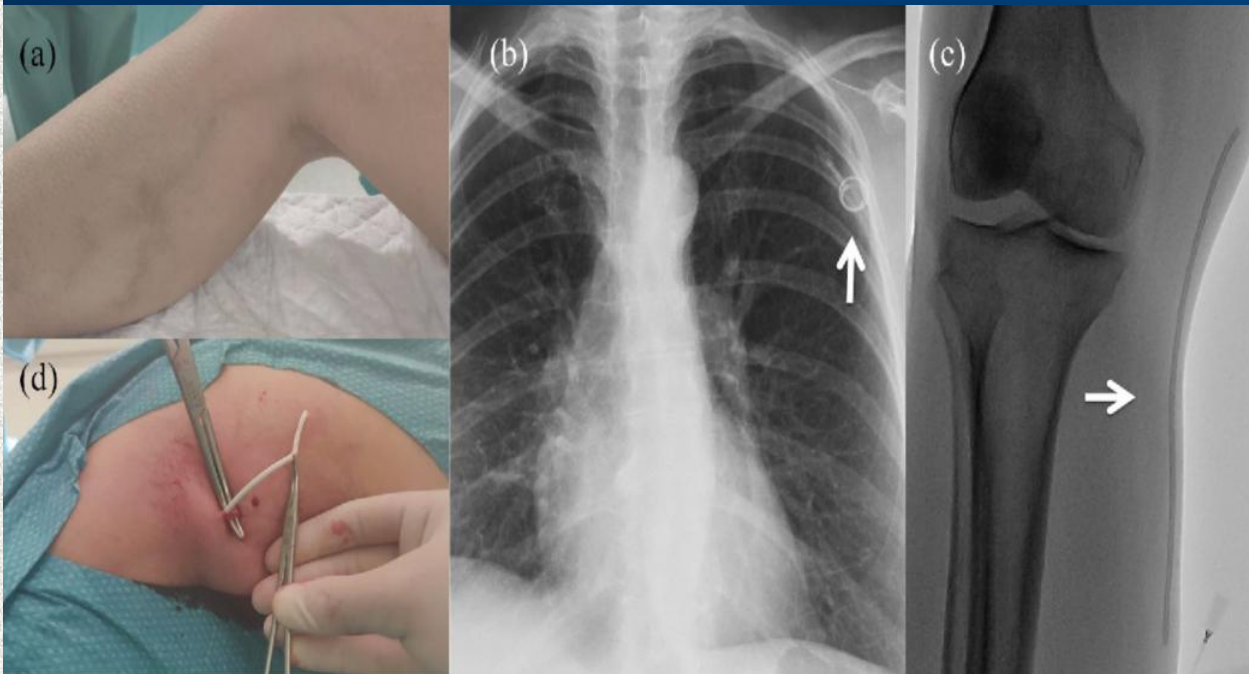
POLIURETANO POWER
INJECTABLE



STRATEGIE DI PREVENZIONE ROTTURA VAD

Embolisation of silicone rubber catheters used for intravenous feeding; a preventable complication

D.J. Almond  • P.N. Silverton • M.J. McMahon



- NON USARE CATETERI FRAGILI (SILICONE)
- EVITARE CATETERI CUFFIATI
- NON USARE TAGLIENTI PER LA RIMOZIONE
- TIMING DI SOSTITUZIONE DEL CATETERE

RESEARCH

Open Access

Stuck fragment of totally implantable central venous access ports during removal: risk factor analysis in children

Hanna Jung¹, Joon Yong Cho¹, Yangki Seok² and Youngok Lee^{1*}



Table 4 Comparison of patient characteristics during totally implantable central venous access ports removal

Characteristics	Complete removal (Group N, n = 90)	Stuck fragment (Group S, n = 8)	p-value
Sex			0.048
Male	55 (61.1%)	8 (100.0%)	
Female	35 (38.9%)	0 (0.0%)	
Age at TICVAP insertion (months)	85.0 [17.0;144.0]	37.5 [31.5;57.0]	0.357
Body weight at TICVAP insertion (kg)	24.6 [11.7;48.0]	17.0 [15.2;19.1]	0.206
Age at TICVAP removal (months)	110.0 [40.0;163.0]	90.0 [84.5;117.5]	0.922
Body weight at TICVAP removal (kg)	32.0 [16.5;50.0]	32.1 [27.1;43.2]	0.704
Indwell duration of TICVAP (months)	10.5 [5.0;20.0]	54.5 [52.0;60.0]	<0.001
Body weight change during indwell (kg)	3.5 [1.2; 7.5]	12.9 [12.2;17.6]	<0.001
Follow-up duration (months)	86.5 [44.0;100.0]	91.0 [80.0;102.5]	0.399
Diagnosis			<0.001
Acute leukemia	23 (25.6%)	8 (100.0%)	
Remaining diagnoses ^a	67 (74.4%)	0 (0.0%)	
Platelet count at TICVAP insertion (10 ³ /ul)	294.5 [182.0;376.0]	71.5 [19.0;102.0]	<0.001
TICVAP insertion indication			0.713
Chemotherapy	73 (81.1%)	8 (100.0%)	
Intravenous therapies	13 (14.4%)	0 (0.0%)	
Nutritional support	4 (4.4%)	0 (0.0%)	
TICVAP insertion site			0.534
Left subclavian vein	63 (70.0%)	8 (100.0%)	
Right subclavian vein	19 (21.1%)	0 (0.0%)	
Right internal jugular vein	4 (4.4%)	0 (0.0%)	
Left internal jugular vein	3 (3.3%)	0 (0.0%)	
Femoral vein	1 (1.1%)	0 (0.0%)	
TICVAP insertion site			0.102
Left subclavian vein	63 (70.0%)	8 (100.0%)	
Remaining insertion sites ^b	27 (30.0%)	0 (0.0%)	
TICVAP catheter size			0.568
5 Fr	22 (24.4%)	2 (25.0%)	
6.5 Fr	62 (68.9%)	5 (62.5%)	
8 Fr	6 (6.7%)	1 (12.5%)	
TICVAP catheter material			1.000
Polyurethane	22 (24.4%)	2 (25.0%)	
Silicon	68 (75.6%)	6 (75.0%)	

Conclusion

We suggest a prophylactic catheter exchange before an indwell duration of 46 months and a body weight change up to 9.9 kg to prevent a stuck fragment of the catheter.

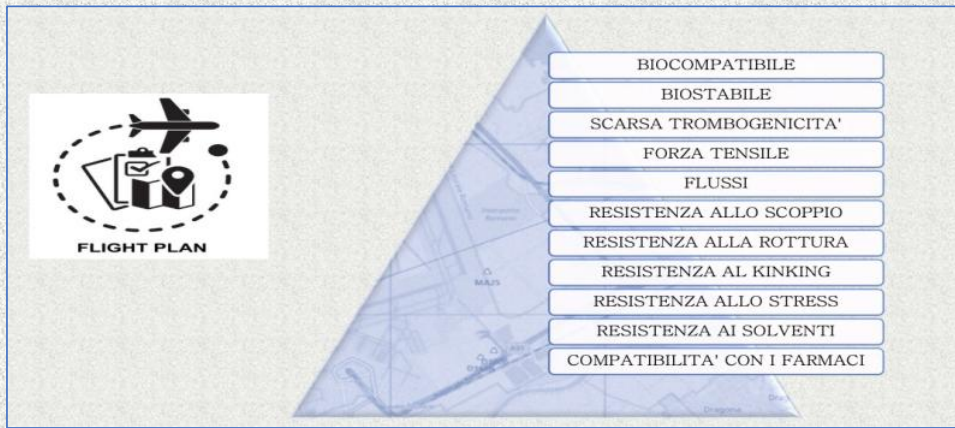
Embolization of a Fractured Peripherally Inserted Central Catheter to Pulmonary Arteries: A Sporadic Life-Threatening Phenomenon

Amitabh Kumar Upadhyay¹, Binayendu Prakash², Shashank Shekhar³, Abhishek Kumar⁴, Aaditya Prakash⁵

1. Medical Oncology, Tata Main Hospital, Jamshedpur, IND 2. Cardiology, Tata Main Hospital, Jamshedpur, IND 3. Medical Oncology, Meherbai Tata Memorial Hospital, Jamshedpur, IND 4. Nuclear Medicine, Tata Main Hospital, Jamshedpur, IND 5. Radiation Oncology, Tata Main Hospital, Jamshedpur, IND

A PICC is made of silicone or second- or third-generation polyurethane. Polyurethane PICCs have thinner lumen walls and larger internal diameters, which leads to higher flow rates; they have a lesser probability of fracture of the catheter but are associated with a higher incidence of thrombosis compared to silicone PICCs. Silicone is more biocompatible than most polyurethane catheters and so more suitable for long-term use with a comparatively higher risk of catheter fracture. In a review by Seckold et al., lower infection rates, dislodgement, thrombus, and fracture rates were found with polyurethane PICCs [18]. Mou et al. have shown a higher incidence of catheter breakage with silicone catheters [19]. In a study by Ong et al., an increased incidence of phlebitis but equal catheter fracture and migration rates were reported in the silicone catheters compared to the polyurethane catheters [20].

CONCLUSIONI 1



SCELTA PROATTIVA DEL MATERIALE



PERMANENZA DEL CATETERE



INSERZIONE SICURA



RIMOZIONE SICURA

CONCLUSIONI 2

LA SCELTA DEI MATERIALI DEL VAD CONDIZIONA TUTTA LA VITA DEL CATETERE



TAKE HOME MESSAGE

I cateteri venosi centrali in P-PUR costituiscono attualmente i devices a medio-lungo termine più utilizzati e sono da preferire nella programmazione di un accesso vascolare essendo caratterizzati da:

- Ottimale performance clinica: affidabilità e versatilità (durata, sicurezza e minor % di complicanze)
- Ottimale rapporto costo benefici



GRAZIE PER L'ATTENZIONE



czanaboni@ao.pr.ir



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