Technique of ultrasound guided peripheral venous access in the emergency room

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Background

Acutely ill patients admitted to the Emergency Department constantly need a fast and reliable peripheral venous access, which sometimes may be difficult to obtain, because of poor visualization of the superficial veins of the arm due to oedema, obesity, hypovolemia, injection drug use or local conditions for previous treatments.

In such cases, a central line is often considered and inserted (also if not strictly indicated), though such maneuvre is potentially time consuming and possibly associated with complications, particularly in the patient with a poor coagulative state.

Furthermore, central lines inserted in the emergency room are known to be at high risk of infection and most guidelines recommend that they should removed within 24-48 hrs.

Background (2)

Thus, in this setting, ultrasound guided placement of a peripheral venous access might be more rapid, safer and more cost effective than a central line.

Many studies of the last decade have discussed the pros and cons of ultrasound guided peripheral access in the emergency room, the main disadvantages being the difficulty in properly cannulating the vein with a short needle-cannula as well as the short life of the access, with rapid dislocation.

Ultrasound-Guided Brachial and Basilic Vein Cannulation in Emergency Department Patients With Difficult Intravenous Access

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Barry C Simon, MD
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101 pts. enrolled (requiring a PIV and after two unsuccessful attemps of blind insertion)

US guided insertion

Success in 91 pts (91%)

In 73 (73%), success at first attempt

Median time for insertion: 77 sec.

In 8 pts. dislocation within 1 hour from insertion

In 42 pts dislocation within 24 hours

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Original Contribution

Ultrasonography-guided peripheral intravenous catheter survival in ED patients with difficult access☆

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Abstract

Objectives: We determined the survival and complications of ultrasonography-guided peripheral intravenous (IV) catheters in emergency department (ED) patients with difficult peripheral access.

Methods: This was a prospective, observational study conducted in an academic hospital from April to July of 2007. We included consecutive adult ED patients with difficult access who had ultrasonography-guided peripheral IVs placed. Operators completed data sheets and researchers examined admitted patients daily to assess outcomes. The primary outcome was IV survival >96 hours. As a secondary outcome, we recorded IV complications, including central line placement. We used descriptive statistics, univariate survival analysis with Kaplan Meier, and log-rank tests for data analysis.

Results: Seventy-five patients were enrolled. The average age was 52 years. Fifty-three percent were male, 21% obese, and 13% had a history of injection drug use. The overall IV survival rate was 56% (95% confidence interval, 44%-67%) with a median survival of 26 hours (interquartile range [IQR], 8-61). Forty-seven percent of IVs failed within 24 hours, most commonly due to infiltration. Although 47 (63%) operators reported that a central line would have been required if peripheral access was unobtainable, only 5 (7%; 95% confidence interval, 2%-15%) patients underwent central venous catheterization. Only 1 central line was placed as a result of ultrasonography-guided IV failure. We observed no infectious or thrombotic complications.

Conclusion: Despite a high premature failure rate, ultrasonography-guided peripheral IVs appear to be an effective alternative to central line placement in ED patients with difficult access.

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Original Contribution

The effect of vessel depth, diameter, and location on ultrasound-guided peripheral intravenous catheter longevity ☆

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Abstract

Introduction: Ultrasound-guided peripheral intravenous catheters (USGPIVs) have been observed to have poor durability. The current study sets out to determine whether vessel characteristics (depth, diameter, and location) predict USGPIV longevity.

Methods: A secondary analysis was performed on a prospectively gathered database of patients who underwent USGPIV placement in an urban, tertiary care emergency department. All patients in the database had a 20-gauge, 48-mm-long catheter placed under ultrasound guidance. The time and reason for USGPIV removal were extracted by retrospective chart review. A Kaplan-Meier survival analysis was performed.

Results: After 48 hours from USGPIV placement, 32% (48/151) had failed prematurely, 24% (36/151) had been removed for routine reasons, and 44% (67/151) remained in working condition yielding a survival probability of 0.63 (95% confidence interval [CI], 0.53-0.70). Survival probability was perfect (1.00) when placed in shallow vessels (<0.4 cm), moderate (0.62; 95% CI, 0.51-0.71) for intermediate vessels (0.40-1.19 cm), and poor (0.29; 95% CI, 0.11-0.51) for deep vessels (≥1.2 cm); $P < .0001$. Intravenous survival probability was higher when placed in the antecubital fossa or forearm locations (0.83; 95% CI, 0.69-0.91) and lower in the brachial region (0.50; 95% CI, 0.38-0.61); $P = .0002$. The impact of vessel depth and location was significant after 3 hours and 18 hours, respectively. Vessel diameter did not affect USGPIV longevity.

Conclusion: Cannulation of deep and proximal vessels is associated with poor USGPIV survival. Careful selection of target vessels may help improve success of USGPIV placement and durability.

These disadvantages may be overcome by using longer peripheral cannulas - made of polyurethane or polyethylene - and inserting them with ultrasound guidance

Different types of long cannulas can be used:

polyurethane (PUR) catheters

- 10 cm 4Fr 18G PUR cath.,
- 54mm 19G needle + 30 cm guidewire

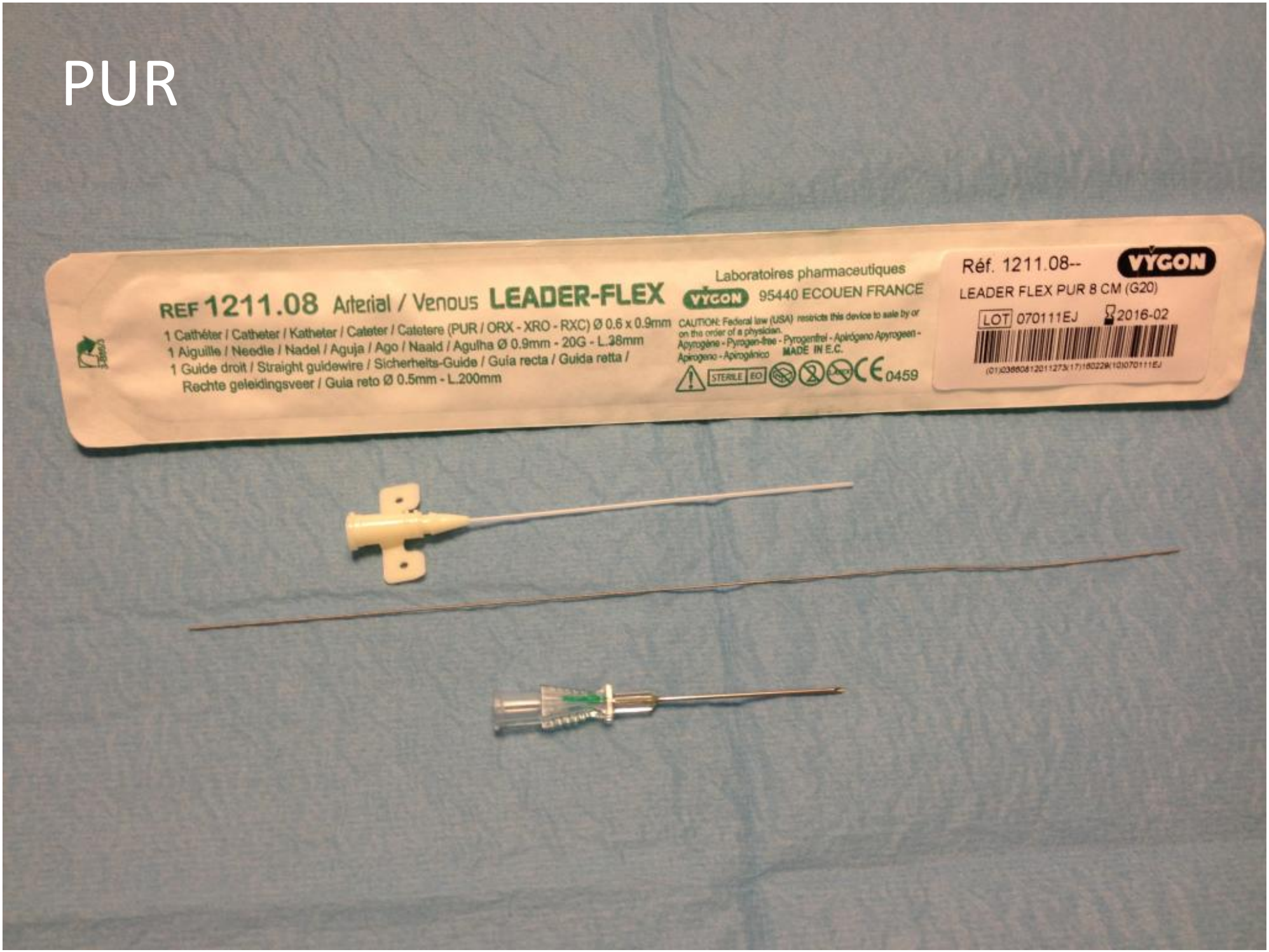
polyurethane (PUR) catheters

- 8 cm 20G PUR cath.,
- 38mm 20G needle + 20 cm guidewire

polyethylene (PE) catheters

- 8 cm 20G PE cath.,
- 38mm 20G needle + 20 cm guidewire

PUR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1 Guide droit / Straight guidewire / Sicherheits-Guide / Guía recta / Guida retta /
Rechte geleidingsveer / Guia reto Ø 0.5mm - L.200mm
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VYGON 95440 ECOUEN FRANCE
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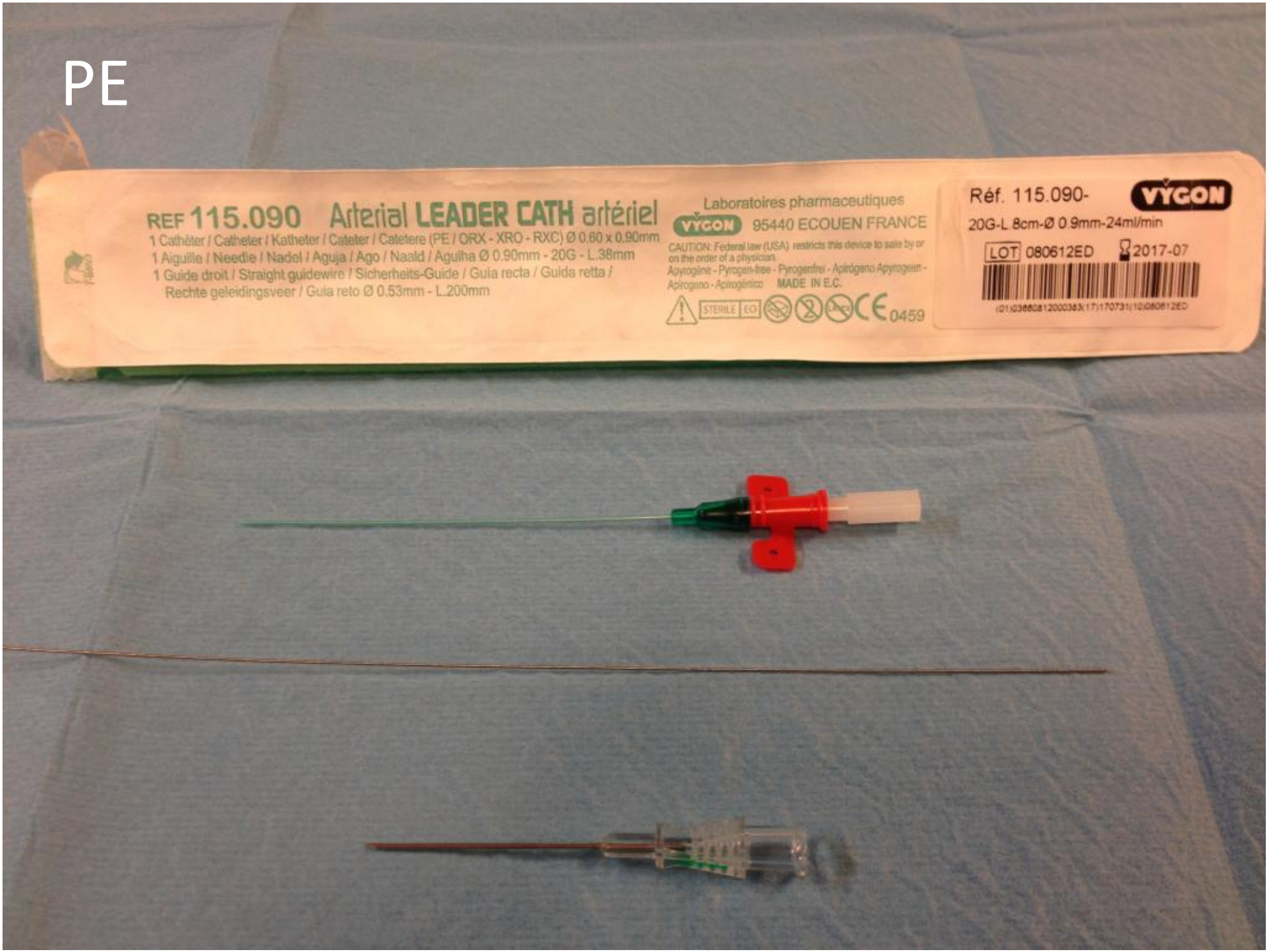
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1 Guide droit / Straight guidewire / Sicherheits-Guide / Guia recta / Guida retta /
Rechte geleidingsveer / Guia reto Ø 0.53mm - L.200mm
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VYGON
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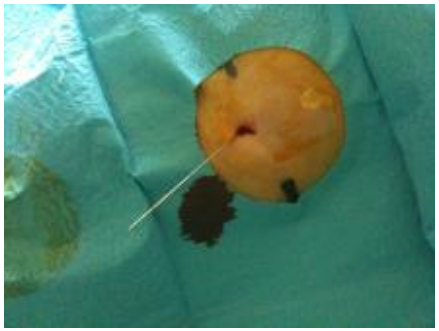
Insertion

1) Ultrasound guidance

2) Simple ('direct')

Seldinger technique



Method

We have reviewed retrospectively our experience with 18G or 20 G polyurethane catheters, 8-10 cm long, inserted by direct Seldinger technique and by real time ultrasound guidance.

Most of the insertion were performed by nurses, in emergency conditions, exclusively in patients candidate to a peripheral line

Results

In 2011, 76 long peripheral catheters were inserted in emergency conditions, using ultrasound guidance and direct Seldinger technique.

The success rate of insertion was 100%

The median time for insertion was 8 minutes.

Veins used for insertion were:

- Basilic vein 45%
- Brachial veins 22%
- Cephalic vein 15%
- Veins of the forearm 18%

Results

Most lines (73%) lasted one week and were used for different purposes, including contrast medium injection.

After 1 week, the catheter was removed for end of use or to insert a different type of venous access.

In 27 % of patients, the catheter was removed before 1 week for end of use.

No dislocations were observed

No infections or thrombosis were reported

Conclusion

The simultaneous use of ultrasound guidance and of the direct Seldinger technique allows a rapid and safe placement of the catheter in a vein of the arm or of the forearm, even when the vessel cannot be palpated or seen, as long as it can be visualized by ultrasound.

Conclusion (2)

The long life of this type of peripheral line is due by the material (polyurethane being more biocompatible than Teflon) and by the length of the catheter (which reduces the risk of dislocation).

Conclusion (3)

Also, these catheters are particularly cost effective if compared to a central line or to a midline catheter, since a complete kit including catheter, 21G needle and 20 cm guidewire costs between €15 and €20.

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Thank you for your attention!

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