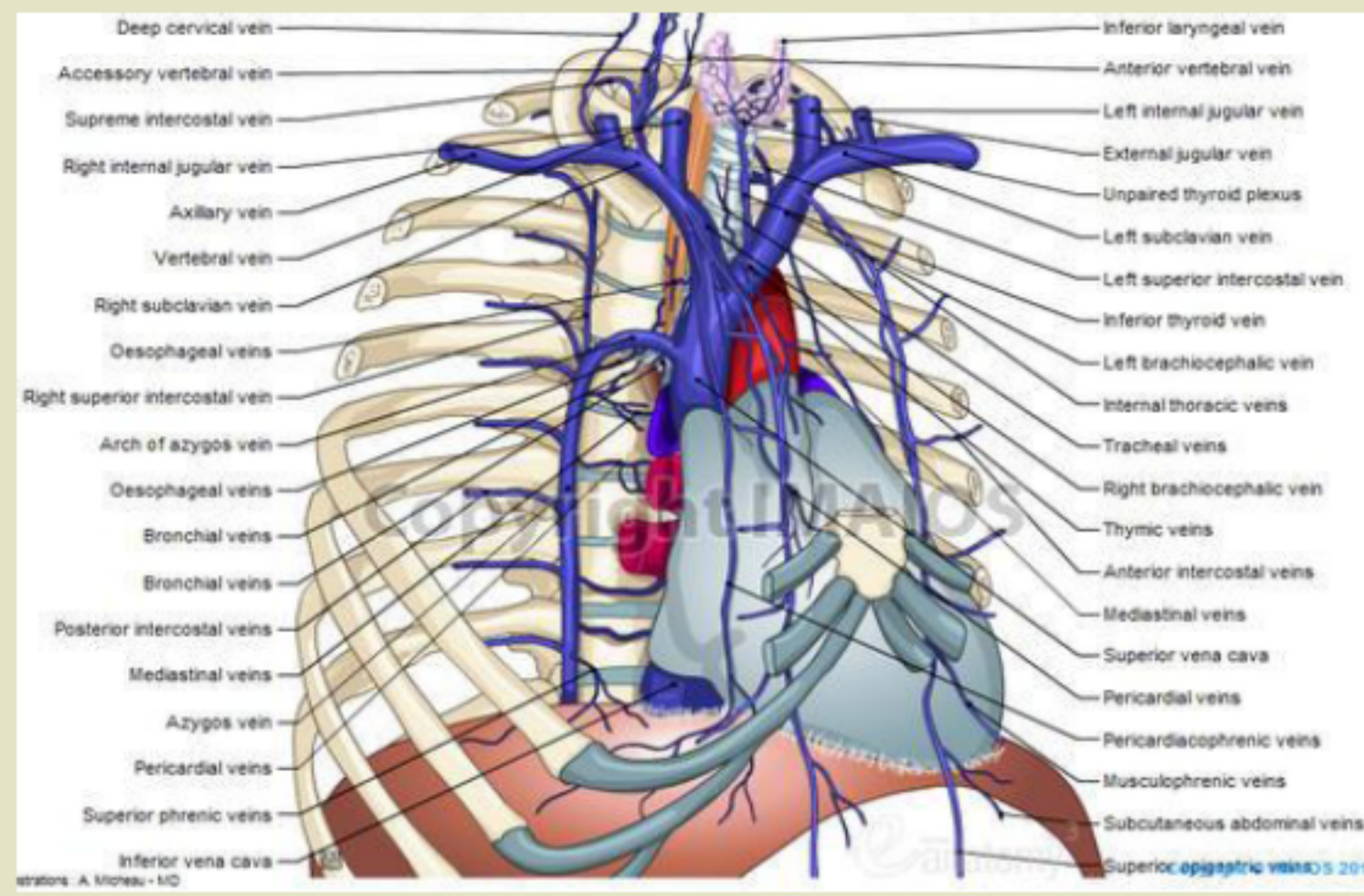


Department of Nephrology, Transplantology and Internal Medicine, Department of Occupational and Internal Medicine, Department of Radiology Informatics and Statistics, Medical University of Gdańsk, Poland

## Background.

Tunneled catheters are becoming increasingly used as a permanent dialysis access. Easy way of insertion and good long-term patency make them competitive to fistulas in some groups of patients.



## Material and methods.

We have analyzed complications and survival of tunneled catheters inserted in the Department of Nephrology, Transplantology and Internal Medicine from June 2010 to December 2013. The observation was ended in June 2014. One hundred eighty six catheters were inserted in 177 unselected patients treated in our dialysis unit and in 13 other dialysis units in the northern Poland.

Preferred vein was right internal jugular vein (IJV). If its cannulation was not possible due to skin infection at this site, thrombosis or lack of visible right IJV on ultrasound, left IJV was used for cannulation. Femoral and subclavian veins were used as next options.

## Results

One hundred eighty catheters were analyzed in 171 patients. In 6 patients not enough clinical data were retrieved and they were considered as lost to follow up.

Arrow Cannon II catheter (with backward tunneling) was used in 147 cases, Bard HemoSplit™ in 30 cases, and Covidien Tal Palindrome™ in 3 cases. In 133 cases catheter was inserted into the right IJV, in 22 cases into the left IJV. Right and left subclavian veins were used in 11 and 2 cases, and right and left femoral veins in 8 and 3 cases, respectively.

The cumulative time of observation was 2103,5 patients-months and median observation was 9 months (range 0,5-45 months).

19 catheters were removed for complications, among them the most common cause was infection, both catheter related sepsis and tunnel or exit site infection. Data on catheter outcome are presented in Table 2.

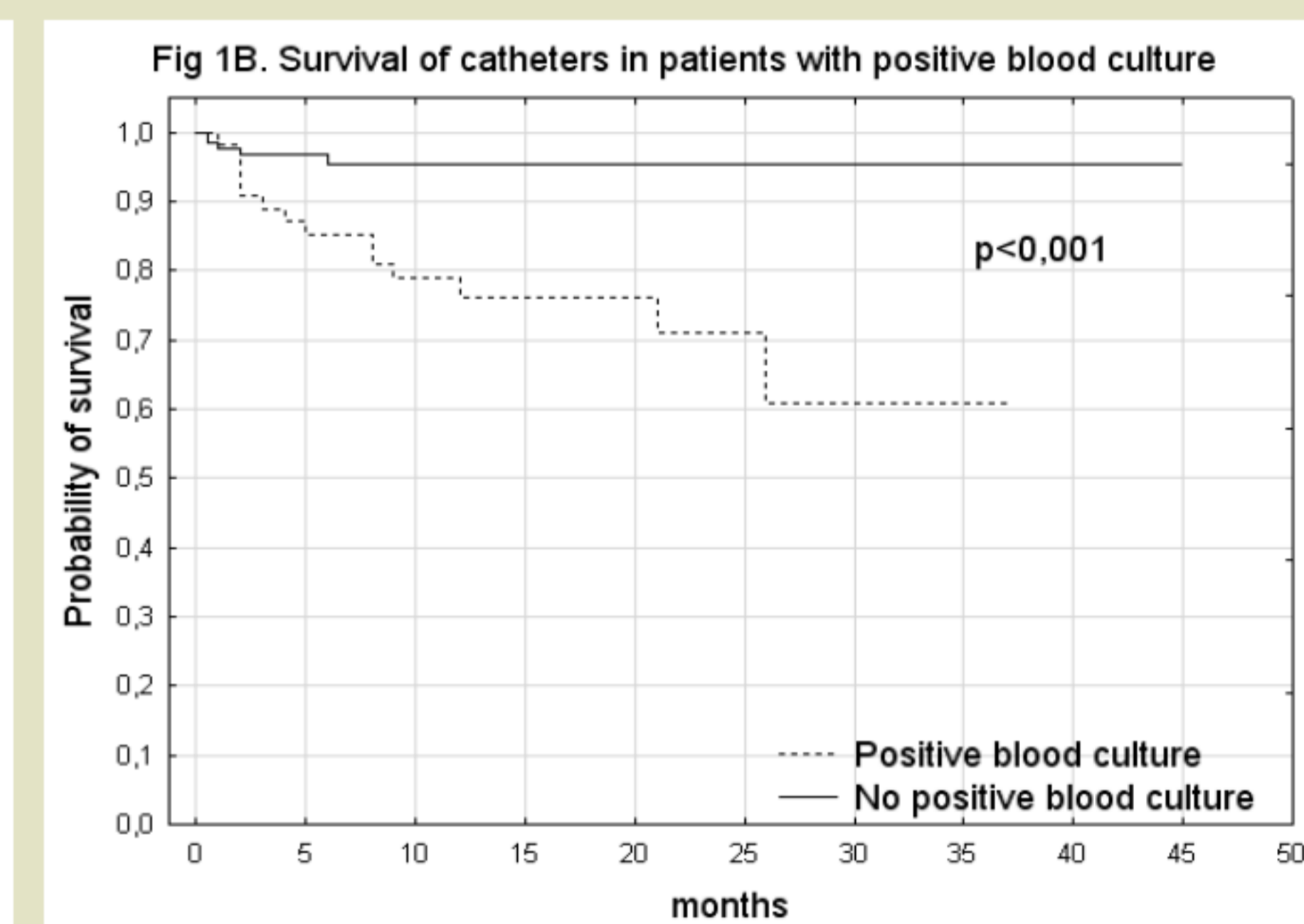
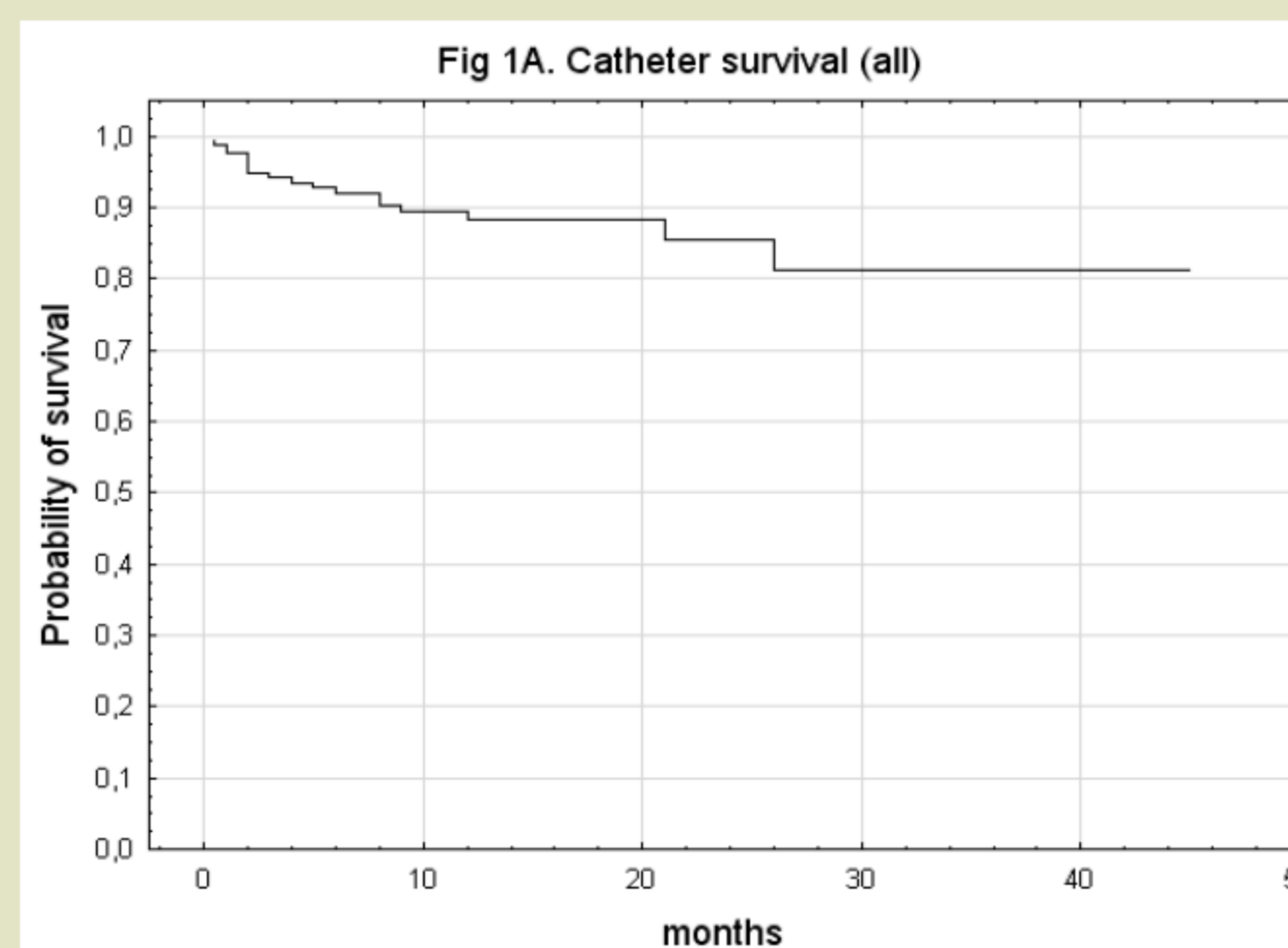
When censored for death with functioning catheter, 94,2 % tunneled THC survived 3 months, 92,0% - 6 months and 88,2 %, 85,6% and 81,1% survived 1, 2 and 3 years, respectively (Fig. 1A). The longest observed catheter survival was 45 months. We did not observe differences in catheter survival with respect to sex, catheter type or, interestingly, type of insertion (primary vs. secondary). Diabetes was not a risk factor for catheter loss. During the observation in 124 patients no positive blood culture has been recorded. In total, 90 positive blood cultures have been documented in 56 patients. These patients had significantly greater chance for catheter loss in comparison to patients without infection (Fig 1B). The majority of cultured species (73 isolates) were Gram (+) cocci - (54 S. epidermidis, 14 S. aureus and 5 Enterococci). Seventeen Gram negative bacteria species were cultured (12 Enterobacteriaceae, 2 Acinetobacter sp. and 3 Pseudomonas sp.). The mean infection rate was 1,42/1000 catheter days or 0,5 episode/year.

	n	%
<b>N (catheters)</b>	<b>180</b>	<b>100</b>
<b>Patients</b>		
sex (M/F)	92/88	51,1/48,9
age (years)	65,2 ± 14,9 (median 65 y)	
<b>Kidney disease diagnosis</b>		
Glomerulonephritis	47	26,1
Diabetic nephropathy	38	21,1
Hypertensive nephropathy	21	11,7
Interstitial renal disease	13	7,2
ADPKD	10	5,6
Other/undetermined	51	28,3
<b>Catheter insertion</b>		
primary/secondary	<b>94/86</b>	<b>52,2/47,8</b>
<b>Catheter type</b>		
Arrow Cannon II	147	81,7
Bard HemoSplit	30	16,7
Covidien Tal Palindrome	3	1,6

Table 1. Patients' characteristics

	n	%
<b>Catheter outcome</b>		
<b>Removal – catheter related complications</b>	<b>19</b>	<b>10,5</b>
Catheter related sepsis	9	5,0
Malfunction/clotting	4	2,2
Tunnel infection	3	1,7
Mechanical damage	3	1,7
<b>Removal – other</b>	<b>39</b>	<b>21,7</b>
AVF creation	27	15,0
Transfer to peritoneal dialysis	5	2,8
Successful kidney transplant	4	2,2
Recovery of renal function	3	1,7
<b>Alive with functioning catheter</b>	<b>58</b>	<b>32,2</b>
<b>Died with functioning catheter</b>	<b>64</b>	<b>35,6</b>

Table 2. Catheter outcome



There were no differences in survival between catheters introduced through the right or left internal jugular veins, but catheters inserted into jugular veins had significantly better survival in comparison to ones in femoral veins ( $p=0,024$ )(Fig1C). Catheter survival was significantly better in older patients. Patients over 65 years had marginal but significant superior catheter survival when compared to younger patients (Fig1D). As 65 years was median age in our study group, both age subgroups had similar number of patients.

## Conclusions

In our opinion the key factor in catheter function and survival is the expertise and dedication of the team performing catheter insertion and rigorous catheter care in the dialysis units. Careful pre-implantation assessment of the access point with the use of ultrasound, proper choice of the catheter length with respect to body size and insertion side, together with the adherence to strict aseptic technique during catheter insertion, care and HD connections seem to be the cornerstones of the success. In the light of the increasing age of dialysis population, the expansion of dialysis in the developing countries, where vascular surgery facilities may not be able to serve the growing number of HD patients, and with better outcomes achieved with THCs, we should not discriminate against dialysis catheters, but use them wisely to achieve best patients' outcomes.

