Prevalence of Bacterial infections in subclavian double lumen catheter for haemodialysis in Najaf governorate, Iraq

Dr.Maitham Ghaly Yousif, Ph.D.
Department of Biology, College of Science, Al-Qadysia University

انتشار اصابات جرثومة Aeromonas hydrophila لدى المرضى الخاضعين لغسل الدم باستخدام قسطرة الوريد تحت الترقوى

الدكتور ميثم غالي يوسف / جامعة القادسية / كلية العلوم/ قسم علوم الحياة

الخلاصة

الموضوع وهدف الدراسة: ان استخدام قسطرة الوريد تحت الترقوى لغسل الدم من اكثر الطرق المستخدمة للمرضى الذين يعانون من الفشل الكلوي المزمن في مستشفيات العراق. ان هدف الدراسة هو تقييم عوامل الخطورة لعلاقة الاصابة مع ادخال القسطرة الوريدية تحت الترقوى لغسل الدم .

المرضى وطريقة العمل: شملت الدراسة ٣٢٢ مريض لديهم فشل كلوي مزمن حضروا الى مستشفى الصدر التعليمي في محافظة النجف للفترة من كانون الثاني ٢٠٠٩ ولغاية كانون الثاني ٢٠١٠ . تم تقسيم المرضى الى ثلاثة مجموعات المجموعة الاولى ضمت المرضى الذين خضعوا للقسطرة لاول مرة والمجموعة الثانية ضمت الذين خضعوا للقسطرة للمرة الثانية والمجموعة الثالثة ضمت المرضى الذين اجريت لهم القسطرة للمرة الثالثة. تم زرع العينات التي اخذت من مسحات الجلد المحيط بفتحة القسطرة ، وتم زرع الخثرة المستخلصة من تجويف القسطرة وكذلك زرع الدم لكل مريض . تم اخذ عينة دم من كل مرض لاجراء فحص نسبة اليوريا في الدم ونسبة الكرياتينين في المصل .

النتائج: تم عزل ١٣٠ عزلة بكتيرية من مختلف العينات حيث كانت اكثر الانواع البكتيرية المعزولة هي *Aeromonas hydrophila* *بنسبة*٥١.٥ % واغلبها من مسحات الجلد . تليها جرثومة *Staphylococcus aureus* بنسبة ٣٠.٧% ثم جرثومة *Staphylococcus epidermidis* بنسبة ٢٢.٣% ومن ثم *Pseudomonas aeruginosa* بنسبة ٩.٢ %.

الاستنتاجات: ان تكرار استخدام القسطرة لدى نفس المريض ووصول حالة المريض الذي يعاني عجز الكلى المزمن الى مراحل متفاقمة هي من الاسباب الشائعة في زيادة نسبة الاصابة الجرثومية باستخدام القسطرة الوريدية. تعد جرثومة *Aeromonas hydrophila* الاكثر شيوعا لدى المرضى الخاضعين للقسطرة الوريدية في محافظة النجف.

Abstract

Background and objectives: The insertion of a subclavian dialysis catheter is a common invasive procedure used in patients with chronic renal failure in Iraqi hospital. our aim was to evaluate the risk factors for infection associated with insertion of a double lumen haemodailysis catheter.

Patients and methods: 322 patients with chronic renal failure attending Alsader teaching Hospital in Najaf Governorate from January 2009 to January 2010. Patients divided into three groups the first group those with subclavain double lumen dialysis catheter inserted for the first time ,second group catheter inserted for the second time and third group those with the catheter inserted for third time. Culture was done from swab of skin around the catheter ,clot from catheter and blood. Also blood urea and serum creatinin was done to each patients.

Results:130 isolates were recovered from different specimens the common bacterial isolates(51.5%) were *Aeromonas hydrophila* from skin of patients followed by *Staphylococccus aerueus (30.7%), Staphylococccus epidermidis* (22.3%) and *Pseudomonas aeruginosa (9.2%).*

Conclusions: More frequent changing of subclavain double lumen dialysis catheter and advanced stage with chronic renal failure are common cause of increase infection in subclavian double lumen haemodialysis catheter. *Aeromonas hydrophilia* is the most common bacteria encountered in subclavian double lumen haemodialysis catheter.

Key words: infection ,*Aeromonas hydrophila* , subclavian double lumen catheter, haemodailysis

Introduction

The insertion of a subclavian dialysis catheter is the preferred mode of vascular access for acute dialysis by most nephrologists over the other modes of temporary vascular access. However, this procedure is associated with a variety of complications including infection, hemorrhage, arterial puncture, pneumothorax and subclavian stenosis [1-3]. Intravascular catheters are essential in modern medicine, particularly at intensive care units (ICUs). However, they constitute an important source of primary blood stream infection. Approximately 150 million catheters are punctured every year at hospitals and clinics in the United States, more than 5 million of which are central venous catheters [4].Reliable vascular access is one of the most essential features of modern medical care. Unfortunately, the intravascular devices (IVDs) needed to establish reliable access are associated with a significant potential for producing iatrogenic disease, particularly bacteremia and candidemia [5–7]. More than 250,000

IVD-related bloodstream infections occur in the United States each year [5], each associated with attributable mortality rates of 12%–25% [8, 9], prolongation of hospital stay [8–11], and an added health care cost of $33,000–$35,000 [8–11].The major pathogens that cause these infections are the gram-positive cocci, mainly coagulase-negative staphylococci [12, 13]. The skin insertion site and the catheter hub are the most important sources of catheter colonization and subsequent catheter-related bacteremia [14, 15]. In neutropenic patients with hematologic malignancies, the catheter hub, which is frequently manipulated by the sanitary personnel, is a major portal of entry for organisms [16].

The aim of this study was to determine the common pathogens that cause infection in subclavian double lumen catheter in hemodialysis in Alsader Hospital in Najaf Governorate.

Patients and methods

322 patients with chronic renal failure consecutively attending haemdialysis unit who underwent subclavain double lumen dialysis catheter insertion in AlSader teaching Hospital in Najaf Governorate during January 2009 to January 2010 were collected.

Patients divided into three groups the first group including patients with subclavain double lumen dialysis catheter insertion for the first time ,second group those with subclavain double lumen catheter infor hemodialysis for the second time and third group those with subclavain double lumen catheter for hemodialysis for the third time. Historical data were taken from patients included ages ,sex ,presence of chronic diseases including hypertension, diabetes and malignancies.

To determine the source of infection in current study we take a swab from all double lumen catheter in hemodialysis before insertion. Swabs were taken from skin surrounding the catheter with a sterile cotton swab and sent for culture then catheters (as shown in figures 1 and 2) were removed by using sterile technique, and the clot from inside the catheter was sent to culture. blood with drawled for culture and biochemical tests including blood urea and serum creatinin.

Results

In the current study all double lumen (DL) dialysis catheter before insertion were pathogens free due to all 322 DL catheter swab showed negative culture. The characteristics of 322 patients were mean age group 58.4, 140 males , 172 females and 24 of them with chronic diseases as shown in table 1.

Table 1: Patients characteristics

Mean age groups	45.4
Male	150
Female	172
Chronic diseases	24

All the patients included in our study were divided into three groups A,B and C according to the frequency of insertion and we relate these groups to the duration of catheterization in days and this is shown in table 2 which show also that there is a relation between ($p< 0.001$) infection and duration of catheterization and the longest the duration (more than 40 days) will lead to more infection especially if insertion was done for the third time.

Table 2: Duration of inserted subclavain double lumen dialysis catheter (days)

Duration of DL insertion (days)	A				B				C				Total
	Positive culture		Negative culture		Positive culture		Negative culture		Positive culture		Negative culture		
	No	%	No	%	No	%	No	%	No	%	No	%	
Less than 10	6	4.6	44	33.8	17	13	48	36.9	8	6.1	7	5.3	130
10-20	18	13.8	26	32.5	12	15	16	20	6	7.5	2	2.5	80
20-30	15	21.4	20	28.5	16	22.8	12	17.1	4	5.7	3	4.2	70
30-40	8	26.6	5	16.6	6	20	4	13.3	5	16.6	2	6.6	30
More than 40	4	33.3	2	16.6	3	24	1	8.3	2	16.6	0	0	12
Total	51	15.8	97	30.1	54	16.7	81	25.1	25	7.7	14	4.3	322

A: subclavian double lumen dialysis catheter inserted for the first time

B: subclavian double lumen dialysis catheter inserted for the second time

C: subclavian double lumen dialysis catheter inserted for the third time

Most bacteria were recovered from skin around subclavian double lumen dialysis catheter (83%) followed by subclavian double lumen dialysis clots (33.8). While only 15 (11.5%) isolates from blood sample as shown in table 3. This table also showed that most skin isolate was from group C (88%) and also bacteria recovered from blood stream (36%) and DL catheter (64%).

Table 3: number of pathogens that isolated

Group (Number)	Skin		Blood stream		double lumen clot	
	Number	%	Number	%	Number	%
A (51)	40	78.4	2	3.9	10	19.6
B(54)	46	85.2	4	7.4	18	33.3
C (25)	22	88	9	36	16	64
Total	108	83	15	11.5	44	33.8

A: subclavian double lumen dialysis catheter inserted for the first time

B: subclavian double lumen dialysis catheter inserted for the second time

C: subclavian double lumen dialysis catheter inserted for the third time

Blood urea was found to be higher > 40 mg/dl in patients with positive bacterial culture (67.5%) which is significant (P< 0.001) and serum creatinin was also higher (>1.4 mg/dl) in patients with positive culture (P< 0.001) as shown in table 4.

Table 4: biochemical test of patients and relation to positive bacterial culture

Biochemical test		Total No.130 positive culture		Total No.192 Negative culture	
		Number	%	Number	%
Blood urea	More than 40 mgl/dl	88	67.6	80	41.6
	Less than 40 mg/dl	42	32.5	112	58.3
Serum createnin	More than 1.4 mgl/dl	74	56.9	54	28.1
	Less than 1.4 mg/dl	56	43	138	71.8

130 isolates were identified from the three groups of patients with subclavian double lumen dialysis, the common bacterial isolates(51.5%) were *Aeromonas hydrophila* mostly recovered from the skin, followed by *Staphylococccus aerueus (30.7%), Staphylococccus epidermidis* (22.3%) and *P.aeruginosa* (9.2). As shown in table 5.

Table 5:bacterial isolates that isolated from 322 inserted subclavian double lumen catheter dialysis patients

pathogen	A			B			C			total	
	S	BS	DL	S	BS	DL	S	BS	DL	No.	%
A.hydrophila	16	2	4	17	2	6	8	4	8	67	51.1
S.aeureus	9	0	2	14	1	5	5	1	3	40	30.7
S.epidermidis	8	0	2	8	1	2	4	1	3	29	22.3
S.pyogenes	2	0	1	3	0	1	3	0	1	11	8.4
p.aeruginosa	2	0	1	2	0	3	2	1	1	12	9.2
p.merabilis	0	0	1	1	0	1	0	0	0	3	2.3
Enterococcus Spp.	0	0	1	1	0	0	0	1	0	3	2.3
Bacillus Spp.	1	0	0	0	0	0	0	1	0	2	1.5
Total	40	2	10	46	4	18	22	9	16	130	100
	51			54			25			130	100

S= Skin, BS= Blood stream, DL= double lumen

A: subclavian double lumen dialysis catheter inserted for the first time

B: subclavian double lumen dialysis catheter inserted for the second time

C: subclavian double lumen dialysis catheter inserted for the third time

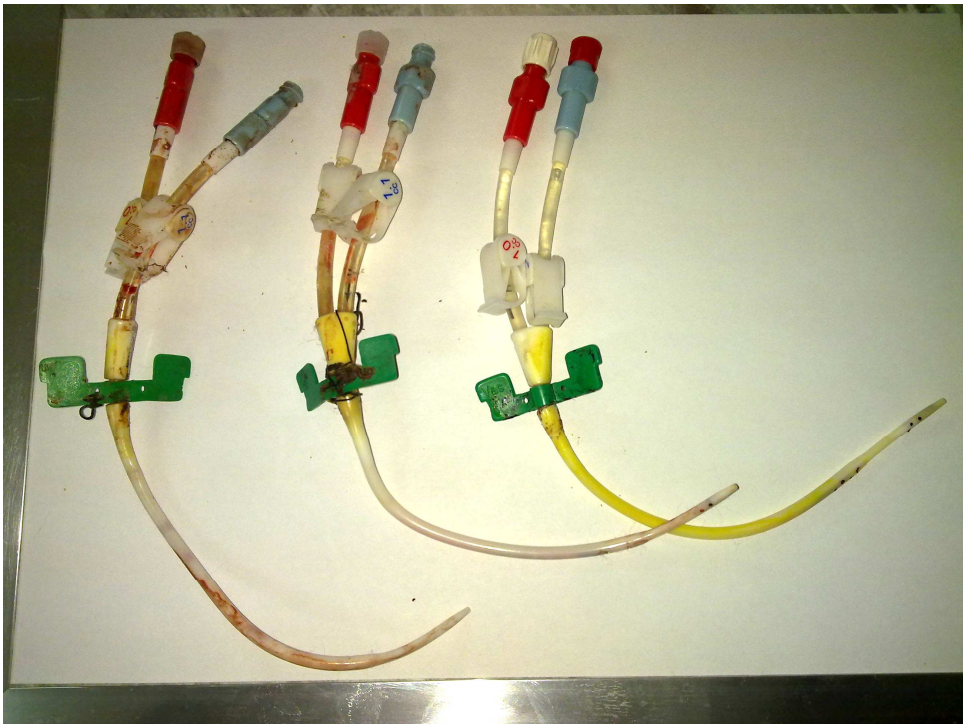

Figure 1: subclavian double lumen catheter for haemodialysis that used in Alsader teaching Hospital in Najaf Governorate

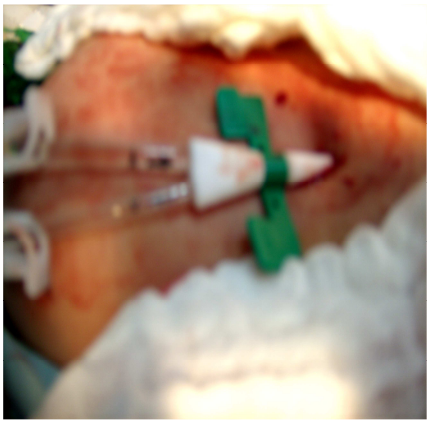

Figure 2: subclavian double lumen catheter for haemodialysis that inserted in patient

Isolation and Identification of **causative agents**

All specimens were cultured on Blood agar and incubated in 37 C for 24 hours, while blood specimen were cultured in brain heart infusion broth for 7-10 days . Identification of bacteria was based on Gram stain, catalase, colony morphology, and biochemical tests[17,18].

Discussion

The risk of infection related to double lumen haemodialysis catheter is high and every effort should be paid to know the risk factors for infection and to determine the most common causative agents that are responsible for infection in these debilitating patients. In the current study we cultured the swabs which were taken from all double lumen haemodialysis catheter before insertion and all the culture was negative in order to exclude any previous contamination that may interfere with our results.

Our study shows the longer the duration of catheterization for subcalvain vein was linked to increase rate of infection especially if the insertion was done for the third time. This is similar to study done by McGee and Gould ,(2003) [10] who found that the duration of the catheterization regarded as a risk factor for blood stream infection. Our study shows most bacteria were recovered from swabs of skin surrounding the catheter and to lesser extent from the catheter itself and the least common from blood in the three group under the study .and this is may be explained as for any microorganisms to cause catheter-related infection, they must first gain access to the extraluminal or intraluminal surface of the device, where they can adhere and become incorporated into a biofilm that allows sustained infection and hematogenous dissemination [20]. Microorganisms gain access by 1 of the 3 following mechanisms: first skin organisms invade the percutaneous tract, probably facilitated by capillary action[21], at the time of insertion or in the days afterward; second microorganisms contaminate the catheter hub (and lumen) when the catheter is inserted over a percutaneous guidewire or when it is later manipulated [22]; or third organisms are carried hematogenously to the implanted intravascular device from remote sources of local infection [23, 24]

Also Raad in 1998 [25] explain that there are 2 major sources of intravascular device contaminations: first colonization of the intravascular device, or “catheter-related infection,” and second contamination of the fluid administered through the device, or “infusate-re-lated infection”. Contaminated infusate is the cause of most epidemic intravascular device; this source has been reviewed else-where.The organisms isolated

from catheter was found in the colt that are adherent inside of catheter. And this can be explained as *In vivo*, coagulation often accompanies bacterial infections of the blood and is believed to be a consequence of immune and inflammatory responses [26-30]. Immune and inflammatory responses cause upregulation of tissue factor on the timescale of hours and lead to increased coagulation[31,32]. One of the few drugs available to treat septic shock, activated protein C, is also an anticoagulant [33]. This coagulation is believed to prevent dissemination of bacteria through the blood[34,35]. but also results in serious vascular damage due to blockage and injury of blood vessels[33].

As a comparison between our study of catheterization of subclavian and other vessels as done by Lorente *et al.* and others [36-38]. Who showed that the predominance of Gram-negative bacteria and fungi cultured from femoral catheters was also described for catheter-related bloodstream infection . Confirming the extraluminal pathogenesis of short-term, catheter-related infection .And the validity of using colonization as a surrogate for catheter related bloodstream infection. Pinilla *et al.* [39] also found a 16% infection rate of internal jugular central venous and pulmonary artery catheters, and only a 7% rate for subclavian catheters. The current study found that most patients who showed positive bacterial culture from different site had blood urea more than 40 mg/dl and serum creatinin more than 1.4 mg/dl ,this can be explained by either patient with sever renal failure manifested by high Blood urea have low immunity which encourage bacterial growth or renal arginine (precursor of urea) and protein metabolism change in the early response to sepsis as shown by Marcella *et al* [40] .The most common isolated bacteria was *Aeromonas hydrophila ,S.epidermidis* and *S.aueus* from different site including skin ,catheter and blood. Our patient had *Aeromonas hydrophila* bacteraemia. *Aeromonas* species produce a β-lactamase and are therefore resistant to penicillins and frst-generation cephalosporins.[41] Antimicrobial agents most active against *Aeromonas* are third-generation cephalosporins, carbapenems and quinolones.

Eykin [42] found a distribution of bacterial species responsible for catheter-related infections, and reported that *S aureus* accounted for 55% of the bacteremia as associated with IV lines and *Staphylococcus epidermidis* for 23%, whereas E coli was not recorded.

Conclusion

- Insertion of subclavain double lumen catheter dialysis catheter is very common invasive procedure used as haemodialysis access for patients of renal failure in Najaf governorate.
- More frequent changing of subclavain double lumen dialysis catheter and advanced stage chronic renal failure are common cause of increasing infection in subclavian double lumen catheter.
- *Aeromonas hydrophilia* is the most common bacteria encountered in double lumen catheter in Alsader teaching Hospital.

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