

## Hemodialysis Access Complications during the first 30 days; Single Center Experience

Habas Elmukhtar<sup>1\*</sup>, Emsad Salha, Kanonie Wadie

Dr Habas El: Consultant physician, consultant Nephrology, Medical Department, Tripoli faculty of Medicine, Tripoli University

Dr Emsad S: Medical Department, Nephrology Unit

Dr Kanonie Wadie: Medical Department, Medical Intensive Care Unit

Correspondent author: Dr Elmukhtar Habas email habas1962@gmail.com

<https://doi.org/10.54361/ljmr.12.1.02>

### Abstract

#### Background

Temporary hemodialysis (HD) catheter is required mostly in acute and sometimes in chronic renal failure and in other cases. HD catheter is not free of complications.

#### Aim of the study

To assess the common complications occur during HD-catheter insertion and during the first 30-days of insertion.

#### Method

Two hundred-ten patients had temporary HD catheter been inserted in Tripoli Central Hospital and other private clinics in Tripoli. Patients had questionnaire that prepared about the complications. Patients were divided into three groups according to the site of HD catheter insertion at presentation. The complications detected by patients and/or following up doctors reported in the same questionnaire sheet. The data was collected at the end of 30 days after HD-catheter insertion and analyzed for demographic patients feature, and the complications reported at insertion and during the first 30 days.

#### Statistical analysis

Frequency and percentage of commonly occurred complications were analyzed by IBM-SPSS statistical package version 18 program (SPSS inc., Chicago III, USA).

#### Results

Included patients were divided into three groups. Group A: 95 patients had catheter at the jugular veins. Group B: 73 patients had femoral vein canalization, and group C: 42 patients had subclavian vein catheterization. Group A were 65 male and 30 female patients, group B were 42 males and 31 females, and group C had 30 males, and 12 females. Patients mean age was 55.1 years  $\pm$  5.12 and (22 – 68) years of age. Patients included in the study were

randomly allocated into the three groups as they were presented. Pain at the site of insertion and during the first 12 hours was the commonest complications (72.9%), and pain around the insertion site during the first 12 hours reported by 102 (48.6%) patients. Infection at the site of insertion reported in 38.6% of patients. Femoral vein catheterization entrance site infection reported in 45 (55.6%), at subclavian reported in 15 (18.5%) and at jugular veins in 21 (25.9%) patients. Catheter tunnel infection was reported in 11 (5.2%) patients. Catheter tunnel infection was reported more with femoral catheter. Arterial or venous HD catheter lumen blockage reported in 46 (21.9%). Two lumens blockage reported in 61 (29%) patients. Bleeding from the entrance site of the catheter reported during HD sessions reported in 10 (4.8%) patients. Hematoma at insertion site or around it was reported in 52 (24.8%) patients. It was more after femoral vein catheterization 28 (53.8%) followed by jugular 18 (34.6%) and then subclavian catheterization 6 (11.5%) patients.

### **Conclusion**

Pain and infection at the insertion site were the commonest complications of HD catheter insertion. Reducing the rate of these complications depends mainly upon implanting strict septic techniques, and train doctors and nurses about HD insertion complications and care.

### **Key words**

Hemodialysis catheter, double lumen catheter blockage, HD catheter infection, septicemia.

### **Introduction**

HD becomes a standard therapeutic modality, safe and well accepted by end-stage renal disease (ESRD) patients, although HD- dependent patients' life expectancy is shorter than normal population (1). There are various modalities of blood toxins removal as HD, continues renal replacement therapy (CRRT) and peritoneal dialysis. All these modalities need access that should be ideally arterial line and venous line. Unfortunately, arterial puncturing is was more associated with infection, but, recently due to strict infection control and strict septic insertion techniques, femoral HD catheter can stay in place longer with less risk of complication (4). It is reported that about 16-25% of HD patients admitted

painful and may lead to severe complications compared to venous catheterization. This does not mean venous HD catheterization is free of complications (2). Jugular, subclavian and femoral veins are the most commonly used sites for HD catheter insertion (3). Insertion of HD access into femoral vein is safer, and has less complications compared to subclavian and jugular vein canalization during insertion. Previously, insertion of catheter into femoral vein in hospital due to HD vascular access complications as HD catheter lumens blockage either arterial or venous side by thrombus. Infection at insertion site to HD-catheter tip causing bacteremia or/and

septicemia (5-10). Various studies were done to assess the complications of HD-catheter worldwide, up to our knowledge, there was not any study carried in Libya to assess the main complications of HD

### **Aim of the study**

To study the frequency of temporary HD catheter insertion complications at insertion time and during the first 30 days.

### **Method**

Two hundred ten HD patients included in this study. They had been HD inserted in Medical Department at Tripoli Central Hospital and private clinics at Intensive Care Units from January 2017 - January 2018. The sites of HD catheter insertion were at internal jugular, femoral and subclavian veins. Patients included were divided randomly as they presented and according to the suitable site of HD insertion into three groups. Group-A patients had HD catheter inserted into jugular veins. Group-B patient had HD catheter inserted into subclavian veins, and group-C had HD catheter inserted into femoral veins. The patients had their first HD session at the Tripoli Central Hospital HD unit. Those patients who had

### **Statistical analysis**

The data were processed in Excel Microsoft program and Statistical analysis using descriptive methods was done by using IBM-SPSS statistical package version 18 program (SPSS inc., Chicago III, USA).

### **Results**

According to the site of insertion, the patients were divided into three groups.

catheter insertion, and the common causes of HD catheter malfunctioning. Therefore, this study was conducted to study these two issues concerning the temporary HD-catheter.

complications and dialyzed at other HD centers were sent back to Central Hospital for catheter inspection, change or removal and new catheter insertion at another site. Patients' complaints as fever, pain at insertion and/or after insertion, blockage of either one lumen or two lumens, pus discharge, and significant amount of blood loss during insertion or after insertion, and during HD from the catheter insertion point and other complaints, or notes from follow up doctors were recorded in a form given to the patients. Patients had obvious evidence of infection, severe bleeding from catheter insertion site or other sites were usually admitted in the hospital and managed accordingly.

Group A that included 95 patients who had catheter inserted at the jugular veins (either

right or left). Group B included 73 patients who had femoral vein canalization and group C included 42 patients, and they had subclavian vein catheterization. Group A had 65 male and 30 females patient, group

B consisted of 42 male and 31 females, and Group C had 30 male patients and 12 female patients (**table 1**). The patients mean age was 55.1 years  $\pm$  5.12 and ranged between 22 – 68 years of age.

Site	Jugular (%)	Femoral (%)	Subclavian (%)	Total
Male	68.4%	57.5%	21.9%	137
Female	31.6%	42.5%	16.4%	73
Total	45.2%	34.8%	20%	210

**Table 1.** Distribution of HD inserted according to site and sex

The main studied complications were pain at the site of insertion, blood loss, arterial puncturing, hematoma, infection, pneumothorax, catheter lumens blockage and others (**table 2**). Patients complained of significant pain at the time of insertion at insertion site were 153 (72.9%). They were 91 male patients, 62 female patients. Pain around the insertion site during the first 12 hours was reported by 102 (48 males and 54 females) patients. Poor blood flow was noticed in 98 (47 males and 51 females) patients. Internal carotid, femoral and subclavian artery puncturing was reported in 67 (31.9%) of patients who were 28 (41.8%) male and 39 (59.2%) were female patients. Infection at the site of insertion reported in 81 (38.6%) of patients who were 28 (34.6%) male and 53 (65.4%) female patients. Femoral vein catheterization entrance site infection was reported 45 (55.6%), the subclavian

infection reported in 15 (18.5%) and in jugular veins catheterization, 21 (25.9%) patients. Catheter tunnel infection was reported in 11 (5.2%) of patients; 3 (27.3%) were male and 8 (72.7%) were female patients. Catheter tunnel infection was reported more with femoral catheter insertion 6 (54.5%), jugular 3 (27.3%) and subclavian 2 (18.2%). Bacteremia reported in 23 (11%) patients; 9 (39.1%) male and 14 (60.9%) female patients. Bacteremia reported in femoral catheterization in 15 (65.2%). Bleeding from the entrance site of the catheter noticed during HD sessions reported in 10 (4.8%) of patients. They were 2 (20%) male and 8 (80%) female patients. Arterial or venous lumen blockage reported in 46 (21.9%) patients; 15 (32.6%) were male and 31 (67.4%) female patients. Two lumens blockage reported in 61 (29%) patients; 27 (44.3%) male and 34 (55.7%)

female patients. Hematoma at insertion site or around the site was reported in 52 (24.8%) patients. They were 21 (40.4%) male and 31 (59.6%) female patients. Hematoma was reported more after femoral vein catheterization 28 (53.8%), followed by jugular 18 (34.6%), and subclavian catheterization 6 (11.5%) patients.

reported in 6 (2.9%) patients. They were 2 (33.3%) male patients and 4 (66.7%) female patients. Subcutaneous emphysema is more common with female patients and more common with right jugular vein

Pneumothorax was noticed in 38 (18.1%) patients. They were 14 (36.8%) male and 24 (63.2%) female patients. Pneumothorax was more reported with jugular 33 (86.8%) especially on right side 17 (44.7%) than subclavian 5 (13.2%) patients. Subcutaneous emphysema

canalization. Bleeding from the entrance site during HD was more with femoral 6 (60%), jugular 3 (30%) patients, and subclavian vein 10% patients. **Table 2**

Complications	No of patients	Male patients	Female patients
Pain at insertion	153/ (72.9%)	59.5%	40.5%
Pain during 12hrs	102/ (48.6%)	47.1%	52.9%
Poor blood flow	98/ (46.7%)	48.0%	52.0%
Infection at site of insertion	81/ (38.6%)	34.6%	65.4%
Artery puncturing	67/ (31.9%)	41.8%	59.2%
Two lumens blockage	61/ (29.0%)	44.3%	55.7%
Hematoma	52/ (24.8%)	40.4%	59.6%
One lumen blockage	46/ (21.9%)	32.6%	67.4%
Pneumothorax	38/ (18.1%)	36.8%	63.2%
Tunnel infection	11/ (5.2%)	27.3%	72.7%
Subcutaneous emphysema	6/ (2.9%)	33.3%	66.7%
Bacteremia	23 (11.0%)	39.1%	60.9%
Bleeding from insertion site during HD	10/ (4.8%)	20.0%	80.0%

**Table 2.** Complications frequency and percentage.

## Discussion

CKD and ESRD are common death leading diseases in the world, and they become a burden upon the health service providers and the community authorities. CKD and ESRD care require considerable care and have many short and long-term

complications that need huge economical expenses. The increase in the rate of CKD and ESRD worldwide, and in Libya makes the more demands for hemodialysis. The main contributory causes of ESRD in the world as well in Libya are diabetes

mellitus, hypertension and obesity (11-14). During the last 10 years of last century and in this century, health care service was good, and life expectancy in the Libyan community was better than before. This has led to relative increase in the number of old-age population in the Libyan community. The increase in elderly population led to an increase in prevalence of CKD and ESRD. The increase of ESRD and due to wide availability and costless service of HD throughout the country had made HD the main treatment option for ESRD patients (20). In USA, HD via HD-catheter increased to about 25% of HD patients, however, the usage of double-tunneled HD catheter as it advised by the National Kidney Foundation must not exceed 10%. The increased rate of HD-catheter usage has led to an increase in mortality and morbidity rate to approximately 2- 3 times, and serious infection 5-10 times compared to HD through arterio-venous fistulas. This rise in the rate of complications following HD via double-lumen catheter made the National Kidney Foundation to issue statement that stated the rate HD-catheter insertion must not exceed 10% (21-23). Venous-arterial or more commonly dual venous access is needed to draw the blood out and to return the blood back to circulation after hemodialysis-filtration process by special equipment. Inserting hemodialysis access has many complications. Therefore, this study designed to assess the main complications during insertion, and during the first 30 days. In this study, the most common complaint by patients was pain during insertion. This might be due to

rate is not well accommodated by Libyan health services providers and the social local authorities especially during the last 8 years (15). HD is the main renal replacement modality for the ESRD-patients in Libya. Other modalities as peritoneal and renal transplant are not widely available due to many difficulties (16-19). The relative less availability of these modalities, inadequate local anesthesia infiltration at the site of insertion or/and the operators did not give enough time for the local anesthetic agent to do its full action. The second common complaint by patients was pain at the puncturing site during the first 12 hours. This complaint is mostly due to multiple puncture trials, and most of the studied patients had this complaint had not prescribed analgesic drugs by operated doctors after catheter insertion. Furthermore, the routine practice of HD-catheter insertion in most of local hospitals is blind by new trainee doctors, and Doppler ultrasound guided HD insertion is not a common practice. This mal-practice had also led to multiple trials and multiple puncturing sites. This practice might be led also to a higher rate of arterial puncturing and hematoma at the site of HD catheter entrance in this study. All these factors might had attributed to an increase the number of patients complained of pain at the entrance site during insertion and during the first 12 hours. HD catheter induced infection is not uncommon problem in most of HD centers worldwide (24-27). In this study, infection report in 92 patients, and it was more at the site of puncturing than the catheter tunnel.

This increased number of infection was mostly due to inappropriate septic procedure by the operators or/and due to contamination from the surrounding environment at a time of insertion. Furthermore, inappropriate catheter manipulation and care at HD session and during insertion by the operators and nurses might increase the risk of infection. Lumen blockage is a known complication of HD catheter in regular HD-patients (28).

### Conclusion

Although HD catheter is needed to conduct HD as a life-saving procedure in acute situations, it is not free of complications. Strict septic conditions, well-trained doctors, HD technicians and nurses are needed to minimize the complication of temporary HD catheter during the first 30 days.

### References

1. Pozzoni P, Del Vecchio L, Pontoriero G, Di Filippo S, Locatelli F (2004). Long-term outcome in hemodialysis: morbidity and mortality. *J Nephrol.* 7: 87–95.
2. Ravani P, Marcelli D, Malberti F (2002). Vascular access surgery managed by renal physicians: the choice of native arteriovenous fistula for hemodialysis. *Am J Kidney Dis.* 40:1264–1276.
3. Daugirdas JT, Blake PG, Ing TS (2001.). Vascular access for hemodialysis. *Handbook of Dialysis* 3<sup>rd</sup> edn. Philadelphia: Lippincott & Wilkins.
4. Montagnac R, Bernard C, Guillaume J, Hanhart P, Clavel P, Yazji J, Martinez LM, Schillinger F (1997). Femoral indwelling silicone catheter experience of three hemodialysis centers. *Nephrol Dial Transplant.* 12: 772–775.
5. Dhingra RK.,Young EW.,Hulbert-Shearon TE.,Leavey SF.,Port FK (2001). Type of vascular access and mortality in U.S. hemodialysis patients. *Kidney Int.* 60: 1443-1451
6. Roy-Chaudhury P, Duncan H, Barrett W, Elson H, Narayana A, Foley J, Misra S, Lynch PM, Zuckerman D (2003). Vascular brachytherapy for hemodialysis vascular access dysfunction: exploring an unmet clinical need. *J Invasive Cardiol.* 15 Suppl A:25–30.
7. Hung KY, Tsai TJ, Yen CJ, Yen TS (1995) Infection associated with reference double lumen catheterization for temporary hemodialysis: Experience of 168 cases. *Nephrol Dial Transplant.* 10:247–251.
8. Kite P, Dobbins BM, Wilcox MH, Fawley WN, Kindon AJ, Thomas D (1997). Evaluation of a novel endoluminal brush method for in situ diagnosis of catheter related sepsis. *J Clin Pathol.* 50:278–282..

- 
9. Oliver M, Callery SM, Thope KE, Schwab SJ, Churchill DN (2000). Risk of bacteremia from temporary hemodialysis catheters by site of insertion and duration of use, a prospective study. *Kidney Int.* 58(6). 2543-2545.
  10. Bolz K. D., Fjerner G., Wideroe T. E., and Hatlinghus S (1995). Catheter malfunction and thrombus formation on double-lumen hemodialysis catheters: an intravascular ultrasonographic study. *Am. J Kidney Dis.* 25(4). 597–602.
  11. Rao GM (1992) Diabetes mellitus in Libya: a retrospective study. *Indian J Med Sci.* 46(6):174–181.
  12. Roaaid RB, Kablan AA (2010). Diabetes mortality and causes of death in Benghazi: a 5-year retrospective analysis of death certificates. *East Mediterr Health J.* 16(1):65–69.
  13. Kadiki OA, Roaaid RB (2001): Prevalence of diabetes mellitus and impaired glucose tolerance in Benghazi Libya. *Diabetes Metab.* 27(6):647–654.
  14. WHO: Eastern Mediterranean Regional Health Systems Observatory-Health Systems Profile- Libya. WHO: 2007. <http://www.emro.who.int>. Accessed December 201.
  15. Salam AA, Alshekter AA, Abd Alhadi H, Ahmed M, Mohammed A (2010): Patient satisfaction with quality of primary health care in Benghazi, Libya. *Libyan J Med .* 5-8.
  16. Usta A, Shawish T, Mishra A, Ehtuish EF, Ajaj H, Milud N, Shebani A, Abdulmola T, Tejori U (2008). Living related kidney transplantation in Libya: a single center experience. *Transplant Proc.* 40(10):3428–3433.
  17. Ehtuish EF, Abouna GM, Shebani AH, Abdulmola TS, Shawesh TZ (2006). Kidney transplantation in Libya and North African and Middle Eastern perspective. *Exp Clin Transplant.* 4(1):425–428.
  18. Abboud O (2006). Incidence, prevalence, and treatment of end-stage renal disease in the Middle East. *Ethn Dis.* 16(2 Suppl 2):S2-2-4.
  19. Najafi I (2009). Peritoneal dialysis in Iran and the Middle East. *Perit Dial Int.* 29(Suppl 2):S217–S221.
  20. Alashek WA, McIntyre CW, Taal MW (2011). Provision and quality of dialysis services in Libya. *Hemodial Int.* 15(4):444–452.
  21. Ethier J, Mendelssohn DC, Elder SJ, Hasegawa T, Akizawa T, Akiba T, Canaud BJ, Pisoni RL (2008). Vascular access use and outcomes: an international perspective from the dialysis outcomes and practice patterns study. *Nephrol Dial Transplant.* 23:3219–3226.
  22. Vazquez MA (2009): Vascular access for dialysis: recent lessons and new insights. *Curr Opin Nephrol Hypertens.* 18:116–121.
  23. Akoh JA (2011): Vascular access infections: epidemiology, diagnosis, and management. *Curr Infect Dis Rep.* 13:324–332.
  24. Lok CE (2007). Fistula first initiative: advantages and pitfalls. *Clin J Am Soc Nephrol* 2007, 2:1043–1053.
  25. Kai W, Pei W, Xianhui L, Xiaoqing L, Zhangsuo L (2015). Epidemiology of hemodialysis catheter complications: a survey of 865 dialysis patients from 14 hemodialysis centers in Henan province in China. *BMJ Open.* 5(11):1-13.



- 
26. Stevens PE, Levin A (2013). Evaluation and management of chronic kidney disease: synopsis of the kidney disease: improving global outcomes 2012 clinical practice guideline. *Annals of Internal Medicine*. 158:825–30.
  27. Ravani P, Palmer SC, Oliver MJ, Quinn RR, MacRae JM, Tai DJ, Pannu NI, Thomas C, Hemmelgarn BR, Craig JC, Manns B, Tonelli M, Strippoli GF, James MT (2013). Associations between hemodialysis access type and clinical outcomes: a systematic review. *J Am Soc Nephrol*. 24:465–73.
  28. Lacson EJ, Lazarus JM, Himmelfarb J, Ikizler TA, Hakim RM (2007). Balancing fistula first with catheters last. *Am J Kidney Dis*. 50:379–95.