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Efficiency of Actolind Solution in Reduction of Jugular Catheter Site Infection in Sudanese Patients with End Stage Renal Disease

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Article History

Received: 16.04.2022

Accepted: 02.06.2022

Published: 07.06.2022

Abstract: **Background:** Hemodialysis (HD) is the most extensively used dialysis method globally, and it necessitates vascular access. Arteriovenous fistulas (AVF), arteriovenous grafts, and central venous catheters (CVC), which can be tunneled or not, are all methods for gaining access. Vascular access is a major risk factor for bacteremia, hospitalization, and mortality among HD patients. The efficacy of Actolind solution in suppressing jugular catheter infection sites in patients with positive jugular catheter culture swab was investigated, as well as the efficiency of Actolind solution opposed to iodine. **Methodology:** This was a prospective, randomized, comparable efficacy clinical trial completed at the renal unit of the Port Sudan teaching hospital's renal dialysis center. The patient group was recruited from across the Red Sea State. A retrospective study of 50 End Stage Renal Disease (ESRD) patients who were either on upkeep HD or were scheduled to receive a kidney transplant as soon as possible. Sociodemographics, comorbidities, and microbiological growth outcomes were gathered prior to and after the interventional procedure. **Results:** According to the results, the male to female ratio was 4:1. There were 39 males and 11 females. All of the patients had ESRD, with 10 of them being hypertensive and diabetic, 34 being diabetic solely, and 16 being hypertension exclusively. Gram positive bacteria, gram negative bacteria, and yeasts constituted 32 (64%), 20 (40%), and 6 (12%) of the cultivars, respectively. Seven patients out of fifty had mixed infections (14%). Forty-one wound swab results after intervention were negative, while nine patients had persistent infection confirmed by positive cultures. **Conclusion:** Removal of CVC due to infection or catheter malfunction occurred less often with Actolind-based lock solutions. We present the prospective comparing Actolind - and iodine -based lock solutions yet. However, due to the retrospective observational nature of this study, conclusions with regard to superiority should be considering.

Keywords: Central Venous Catheter; Hemodialysis; Actolind; Sudanese.

ABBREVIATIONS

ESRD; End Stage Renal Disease

HD; Hemodialysis,

AVF; Arteriovenous fistulas

CVC; Central Venous Catheters

ESI; Exit Site Infections

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Citation: Areeg Salih Abdel Aziz Ahmed *et al* (2022). Efficiency of Actolind Solution in Reduction of Jugular Catheter Site Infection in Sudanese Patients with End Stage Renal Disease. *South Asian Res J App Med Sci*, 4(3), 20-24.

BSIs; Bloodstream Infections,
CRIs; Catheter-Related Infections
ACS; American College of Surgeons
ACAN; American College of Anesthesiologists.

INTRODUCTION

Hemodialysis (HD) is the most extensively used dialysis method globally, and it necessitates vascular access. Arteriovenous fistulas (AVF), arteriovenous grafts, and central venous catheters (CVC), which can be tunneled or not, are all methods for gaining access [1, 2]. Vascular access is a major risk factor for bacteremia, hospitalization, and mortality among HD patients. The type of vascular access most associated with bloodstream infection (BSI) is CVC (48–73%), which also increases morbidity and mortality rates, as well as HD costs. Other infections related to catheter usage are exit site infections (ESI) and tunnel infections [3-6].

Venous access is a primary cause of bacteremia, institutionalization, and deaths among HD patients. CVC (48–73%) tends to be the venous access form more frequently associated with bloodstream infection (BSI), and it significantly boosts estimates of morbidity and mortality, as well as HD expenditures [7, 8]. Moreover, when ESRD patients dialyze using dialysis catheters versus individuals dialyzing through AV fistulae, all-cause mortality is greater [9]. Catheter-related infections (CRIs), which are caused by catheter insertion, are anticipated to be the most common cause of bloodstream infections. According to the American College of Surgeons (ACS), CRIs increase the risk of catheter failure, other causes of death, as well as other serious consequences in patients [10-12]. As a result, attempts to reduce the usage of CVCs and the occurrence of CRIs have been a research emphasis [13, 14]. Particularly in the ICU, a tunneled cuffed catheter is superior to a non-cuffed catheter if emergency dialysis access is indicated, if indeed the catheter will be left in situ for further than three weeks¹⁵. According to the American College of Anesthesiologists (ACAN), routine CVC replacement is not required for catheters that are functioning and have no evidence of causing local or systemic complications. Colonization of the cutaneous tract from the implant site to the vein is commonly the route of infection [16].

A biofilm is a composite created by microorganisms adhering to a dead tissue or artificial surface. Within 24 hours of catheter placement, bacteria begin to cling to the catheter surface. The bacteria multiply and release a polysaccharide matrix that serves as a substrate for new species to attach [17]. Owing to the transfer of microbes from the dermis to the epidermal surface, this process takes place under the skin rather than above it, where antiseptic treatments are ineffective [18]. Microorganism multiplication in the epidermis is inhibited by dressings containing chlorhexidine. Researchers randomly assigned 1,636 patients to catheter dressings with or without chlorhexidine-impregnated pads in a randomized, multicenter assessor-blind study [19].

Regular topical antiseptic dressing is one of the most crucial steps in aiding patients and dialysis staff navigates through this difficult period. However, because topical medicines' efficacy is always compromised by many varieties, clinical trials and observational studies are more crucial. Site infections are prevalent in many dialysis units in Sudan, despite the reality that they constitute. At the Port Sudan renal dialysis center, the efficacy of Actolind solution in suppressing jugular catheter infection sites in patients with positive jugular catheter culture swab was investigated, as well as the efficiency of Actolind solution opposed to iodine. Innovative compounds, such as antiseptic dressings, that reduce the potential for skin-to-vein microbial transmission may inhibit bacterial resettlement from the focus to the circulatory system. This study highlights what is known about these innovative trends and how they may impact personal health.

METHODOLOGY

Study design and Participants characteristics

This was a prospective, randomized, comparable efficacy clinical trial completed at the renal unit of the Port Sudan teaching hospital's renal dialysis center. The patient group was recruited from across the Red Sea State. A retrospective study of 50 End Stage Renal Disease (ESRD) patients who were either on upkeep HD or were scheduled to receive a kidney transplant as soon as possible. We reviewed all patients on chronic dialysis over four months from January to February 2020. Sociodemographics, comorbidities, and microbiological growth outcomes were gathered prior to and after the interventional procedure. All patients on maintenance dialysis who used a non-tunneled or tunneled curved internal jugular catheter were monitored for immediate and short-term consequences. Patients who had femoral catheters were not invited to participate in the trial. Our center adopts the protocol stated below.

Procedure protocol

Dialysis catheter placement

The nephrologist positioned the nontunneled and tunneled internal jugular dialysis catheters. Unless there were technical glitches, the right internal jugular vein was the chosen site for installation. The processes have been accomplished in the hospital's theatre suite and were exclusively aseptic. The retrofitted Salinger's technique was used for catheter implantation, whereas ultrasound imaging monitoring was used in situations when technical complexity was approached when using feature points.

Immediate complications post catheter insertion

The patients were monitored for up to 2 hours post-catheter installation to evaluate the probability of initial problems, as well as undergo chest x-rays performed after catheter insertion. The last was done to determine the catheter's precise position and rule out consequences like pneumothorax, hemothorax, and lung injury.

Intervention

A clinical trial comparing the effects of iodine on jugular catheter infection site management versus 0.1 percent polyhexanide and poloxamer. The study comprised 50 patients on regular hemodialysis who had a catheter site infection, which was indicated as discharge at the site of placement even without fever. Patients underwent iodine dressing after consenting to participate in the study, but wound swabs were taken and the spray was used instead of iodine for such patients. Antibiotic sensitivity was examined after wound swabs were cultivated. Then, after four sessions of wound dressing with Actolind spray, wound swabs were tested to verify whether infection was evident or not.

Statistical analysis

The IBM statistical package for the social sciences (SPSS) for the Windows operating system (20.0) in New York was used to evaluate quantitative data (IBM Corp, NY). The proportions for categorical variables were used (percentage).

ETHICAL CONSIDERATION:

The Red Sea University Ethics Board, as well as the renal dialysis center of the Port Sudan teaching hospital, authorized the procedures involving human participants. Prior to the procedure, all participants received information on why it was needed, the potential issues, and the post-catheter management that had been anticipated.

RESULTS

According to the results, the male to female ratio was 4:1. There were 39 males and 11 females. All of the patients had ESRD, with 10 of them being both hypertensive and diabetic, 34 being diabetic solely, and 16 being hypertension exclusively Table 1. Gram positive bacteria, gram negative bacteria, and yeasts constituted 32 (64%), 20 (40%), and 6 (12%) of the cultivars, respectively. Seven patients out of fifty had mixed infections (14%). Forty-one wound swab results after intervention were negative, while nine patients had persistent infection confirmed by positive cultures Table 2.

Table 1: Demographic characteristic and comorbidity of study group

Parameters	Characteristic	Frequency n=50	Proportion
Gender	Male	39	78
	Female	11	22
Comorbidity	Diabetes mellitus	34	68
	Hypertension	16	23
	Diabetic and hypertensive	10	20

Table 2: Pre and post interventional microbial growth

Parameters	Microbial organisms	Frequency n=50	Proportion
Pre intervention	Gram positive cocci	32	64
	Gram negative bacilli	20	40
	Candida	6	12
	Mixed	7	14
Parameters	Microbial organisms	Frequency n=9	Percentage
Post intervention	Gram positive cocci	5	56
	Gram negative bacilli	3	33
	Candida	1	11

DISCUSSION

This represents the first randomized, prospective, comparative efficacy trial to investigate the outcomes of two different hemodialysis catheter site infection medical interventions: Iodine and Actolind spray. Based on the conclusions, Actolind spray reduces the length of infection more so than traditional iodine, which is less irritating to the skin.

Plenty of research has explored numerous approaches for improving the CR-BSI rate. Others investigated novel biomaterials, antiseptic dressings, and catheter devices, whereas others assessed comprehensive programs to optimize overall infection prevention procedures whilst using catheters, including monitoring, education, and standard management strategies [20]. The preponderance of research shows that adopting an antibacterial toilet or lock solution can effectively minimize catheter-related infections. Adverse effects, toxicity, allergic responses, and the establishment of resistance should all be considered. A broad suggestion is unlikely to achieve much due to the enormous range of chemicals employed, the variability of the clinical populations investigated, and constraints on the size or design of research [21]. Antibacterial or antiseptic formulations placed on catheter-insertion sites boost the rate of fungal growth and encourage the emergence of antibiotic-resistant bacteria. Following catheterization, optimum sterile containment measures are required, such as using a chlorhexidine-based cutaneous antiseptic solution [22]. Our data revealed important information about the choices of solutions used for dressing in jugular catheter site infections. Actolind may be effective as Iodine and beneficial in wound dressing but it has the ability to shorten the duration of infection and no erosive action on the skin surrounding the wound. Clinical effects, spectrum of activity, safety, and cost will be the driving factors for the choice of antiseptic solution.

The fact that there are limited options for instillation solution shortlisting and Iodine was a popular choice may have impacted the study. As there was no comparison group in this trial (50 patients who were on Iodine dressing but still developed catheter site infection), it's impossible to determine if the findings reflect the experimental wound care with the spray.

CONCLUSION

Removal of CVC due to infection or catheter malfunction occurred less often with Actolind-based lock solutions. We present the prospective comparing Actolind - and iodine -based lock solutions yet. However, due to the retrospective observational nature of this study, conclusions with regard to superiority should be considering. Future studies with a large sample size, various Sudanese nephrology institutes, multiple databases, and meta-analyses on professional training with preventive antimicrobial medicines for HD-CVC may have a potential impact on CVC-ESIs mitigation strategies.

ACKNOWLEDGMENT

We are pleased with those volunteers who participated in the study. We appreciate our colleagues at Port Sudan's renal unit's renal dialysis center.

AUTHERS CONTRIBUTION

The manuscript's content and similarity index are the responsibility of all authors, who have evaluated and authorized the ultimate manuscript.

Conflicts of Interest: There were no competing interests declared by the authors.

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