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Article

Investigation of the Etiological Bacterial Agent among Patients Suffering from Uropathogenic and Incisional Infections

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Abstract: Uropathogenic or Urinary Tract Infections (UTI) and incisional surgical site infection (incisional SSI) are a worsening trouble among patients. Objective: Investigate the etiological bacterial agents in patients suffering from uropathogenic and incisional infection. Methods: The study specimens included a total of 52 specimens were gathered randomly from (males and females) patients, aged (1-80) years, in Al-Hussein Teaching Hospital in Al-Muthanna Governorate. 19 Mid-stream sample of urine &33 specimens were gathered aseptically from the incisional sites of patients doubtful to infect with SSIs after Surgery when patients were observation for symptoms and signs of SSIs during hospitalization. Urine sample and pus swabs were immediately brought to the medical microbiology laboratory for test. Results: The isolation rate of Gram-negative bacteria of uropathogenic isolates in this study was 11 (57.89%) greater than Gram-positive bacteria 8 (42.11%); but there is no a statistically significant difference between them. Whereas there is a statistical significant difference between the isolation rate of Gram-positive bacteria of incisional SSIs isolates in this study was 23 (69.697%) and Gram-negative bacteria 10 (30.303%) at p-value less than 0.05. Conclusions: these finding has clarified a major contribution of gram-negative bacterial isolates E. coli was the most dominant urinary tract infection pathogen among the study's participants, according to the study's findings. This could lead to lengthy hospital lodging, high recurrence and high health care costs. Whereas most predominant etiological agent of incisional SSIs was gram positive S. aureus.

Keywords: Incisional, SSIs, Uropathogenic (UTI), Etiological, Bacterial Agent.

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1. Introduction

Despite of improvement in antiseptic, sterilization and surgical technique, Urinary Tract Infections (UTI) and incisional surgical site infection (incisional SSI) are a worsening trouble among patients; these infections affect the surface skin and subcutaneous tissue to deep structures. UTI can progress to complications suchlike epididymitis, orchids and prostatitis in male patients while pyelonephritis, cystitis, in most patients and cause harassment to the patient with staying elongated time in hospital, and rising price and mortality. It estimated more than 13.000 deaths per year while the deaths of SSI reach to 38% of patient [1,2,3]

According to anatomic level of infections (incisional SSI) can be classified into 3 categories are organ infection, deep incisional and superficial incisional. Superficial incisional SSIs are most predominant than the other types and estimate many of all SSIs. There are factors can increase the danger of SSI inclusive extended hospitalization after or before the

surgery, unsuitable sterilization of surgical instruments and lengthy period of surgery. Furthermore, the bacteria insert into the incision site throughout or after the surgery, the virulence of the bacteria depend on the physiological circumstance of each wound are main agents that limited the degree of infection [4, 5].

The most recurrent causative of UTI is bacteria including Gram negative bacilli have prevalent role, additionally, the Gram-positive cocci also have a major role in UTIs. Escherichia coli, majority predominant UTI followed by Proteus spp., Klepsiella spp., Staphylococcus spp., and Pseudomonas spp. [6]

Whereas the most common causing factors of SSI bacteria including Gram positive bacteria followed by gram negative. S. aureus is the most species isolated pathogens; coagulase negative (CoNA) Staphylococci, Enterococcus spp., Pseudomonas aeruginosa and Escherichia coli. [7, 8].

2. Materials and Methods

2.1 Collection of Clinical Specimens

The study specimens included overall of 52 specimens were gathered randomly from (males and females) patients, aged (1-80) years, in Al-Hussein Teaching Hospital in Al-Muthanna Governorate. 19 Mid-stream sample of urine because the midstream specimen indicates actual bacteriological picture of the urinary tract. Whereas, 33 specimens were gathered aseptically from the incisional surgical sites of patients doubtful to have SSI post-surgery when patients were surveillance for symptoms and signs of SSIs during hospitalization, including purulent drainage, pus, redness, or localized swelling. In a nutshell, Samples were taken aseptically from patients' superficial surgical wound using sterile cotton swabs. Swabs and urine sample were delivered right away to microbiology lab [9].

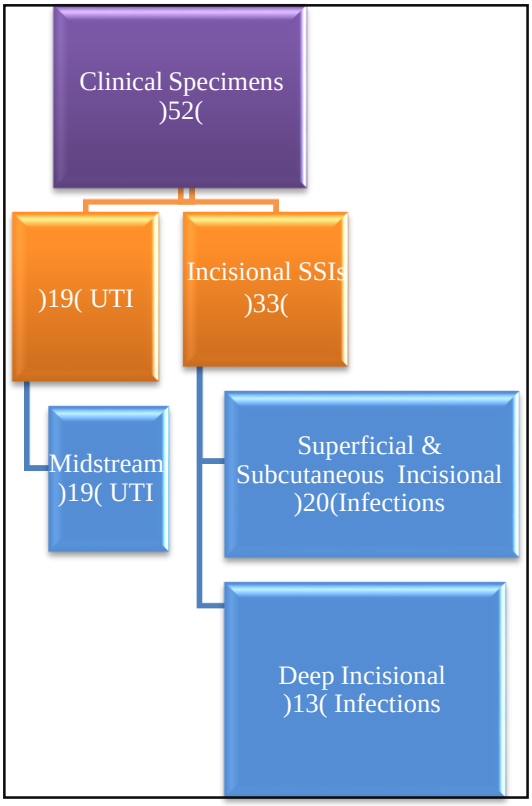

Figure 1. Numbers of Clinical Specimens

2.2 Culture and Investigation Techniques

The collected Mid-stream urine specimens and Incisional SSIs specimens were activation by inoculating method on Nutrient broth (Hi-media/India) and Brain heart Infusion (Hi-media/India) broth then; after aerobically incubation of the tubes for overnight at 35-37°C they were scrutinized for the absence or presence growth in bacterial colonies. If the bacterial colonies were present; further investigation by physical characteristics suchlike Odor, Colony morphology and color, Swarming, presence or absence hemolysis after inoculated the positive culture by streak plate Method onto Blood agar 5% (Micromedia/USA), Mannitol Salt Agar Base (MSAB) (Company of Hi-media/ in India), MacConkey agar CM0007 (OXOID / U.K.), Nutrient agar (Hi-media/India), and then aerobically incubating for the plates at 35-37°C for 1 Day. Furthermore, biochemical tests for the bacteria (Gram positive and gram negative) [6].

2.3 Identification via HiCrome Agar Base, Modified and VITEK 2 Compact System

According to manufacturing company's instructions, aggregate of 30.38 gm. were dissolved in 500 ml of D.W. Then, boiled to resolve the medium completely, without autoclaving, cooled to (45-50) °C. for specific identification depending on the color production via colonies the bacteria isolates were cultured on this media the incubating for the plates at 35-37°C for 1 Day.

The procedure of identification of bacterial colonies aged 24 hours was performed via special program of VITEK2 Compact system provided by Al-Hussein Hospital was used in the data reading of Gram-Positive Identification Cassette Card (GP ID Cassette Card) & Gram-Negative Identification (GN ID Cassette Card) by using Bar Code Scanner Device according to [10].

2.4. Ethical Approval

The official authoritative in the hospital and patients assent or their partner for specimens was gained before starting the work.

2.5 Data Analysis

MedCalc Software Ltd. Comparison of two rates. Version 22.009; 2023; Furthermore, Microsoft Excel (2010) was performed for represented of data such as percentage and charts.

3. Results

The isolates of different bacteria were grown on varies of culture media especially on HiCrome Agar Base, modified for specific identification depending on the color production as in Figure (1).

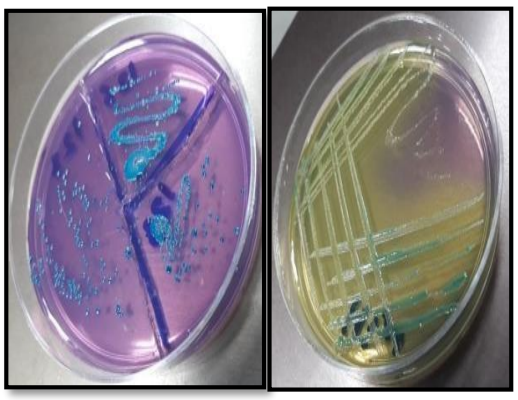

Figure 1. Bacterial colonies on HiCrome Agar Base, Modified after incubation for 24 hours at 35-37 ° C. Blue color for *Staphylococcus epidermidis* while green color *Staphylococcus aureus*.

The Gram negative (-ve) bacteria isolation rate of uropathogenic isolates in this study was 11 (57.89%) greater than Gram-positive bacteria 8 (42.11%); but there is no a statistically significant difference between them.

While the major frequent etiology of uropathogenic bacteria was Escherichia coli (E. coli) that their rate estimated 8 (42.11%) of the total 19 isolates, followed by Staphylococcus au-reus (S. au-reus) 6(31.57%), Proteus spp. 2(10.53) and then Enterococcus spp. 2(10.53) Klebsiella sp. 1(5.26%)as in Figure (2) and Table (1)

Table 1. Number of bacterial isolates among patients with uropathogenic infections

Infection Site	Bacterial Isolates	Number (No.)	Total
Uropathogenic infection	*E. coli*	8	19
	S. aureus	6	
	Proteus spp.	2	
	Enterococcus spp.	2	
	Klebsiella sp.	1	

There is a statistically significant difference between the isolation rate of Gram-positive bacteria of incisional SSIs isolates in this study was 23 (69.697%) and Gram-negative bacteria 10 (30.303%) at p-value less than 0.05.

The most predominant bacterial etiology of incisional SSIs isolates was S. aureus which their rate estimated 13 (39.39%) of the total 33 isolates followed by CoNS 8 (24.25), Pseudomonas aeroginosa 5(15.15), Acinetobacter spp. 2(6.06%), Bacillus spp. 2(6.06%), E. coli 1(3.03%), Moraxella sp. 1(3.03%), and Streptococcus sp. 1(3.03%) as in Table 2. and Figure (2) & Figure (3). There is a statistically significant difference between the Staphylococcus spp. and other bacteria at p-value less than 0.05.

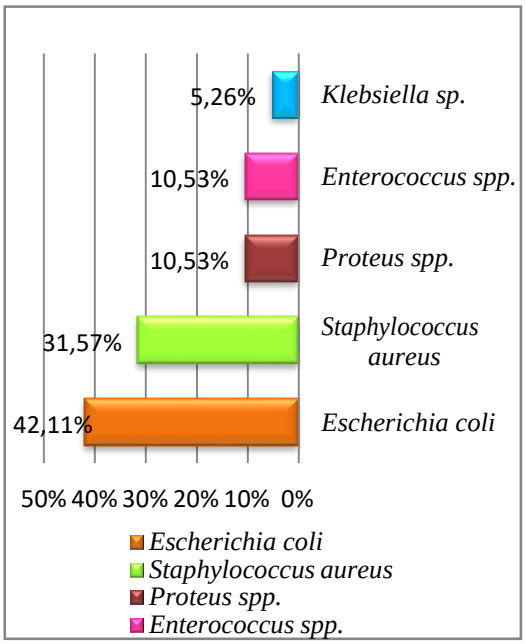

Figure 2. Percentage of bacterial etiology among patients with uropathogenic infections

Table 2: Number for bacterial isolation among patients suffering from Incisional infections

Infection Site	Bacterial Isolates	Number (No.)	Total
Incisional infection	*Staphylococcus aureus*	13*	33
	CoNS	8*	
	Pseudomonas aeroginosa	5	
	Acinetobacter spp.	2	
	Bacillus spp.	2	
	Escherichia coli	1	
	Moraxella sp.	1	
	Streptococcus sp.	1	

There is a statistically significant difference between the Staphylococcus spp. and other bacteria at P-value less than 0.05.

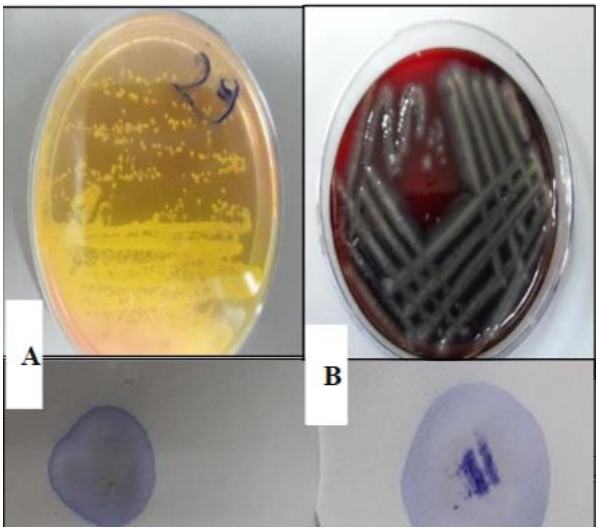

Figure 3. A. Yellow pigment refers to Mannitol fermentation of *S. aureus* colonies on MSAB; the colony in filter paper no color change after 10 second, indicating negative result (Oxidase-negative organisms). B. Colonies of *Pseudomonas aeroginosa* on Blood Agar; colony in filter paper color change to Blue after 10 second, indicating positive result (Oxidase-positive organisms).

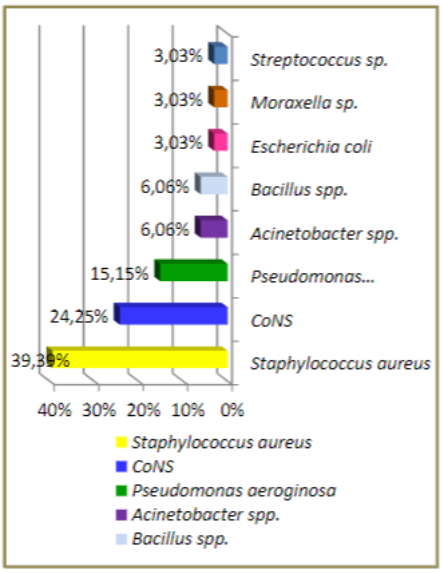

Figure 4. Percentage of bacterial Etiology among patients with Incisional infections

4. Discussion

The majority isolates during this study were gram-negative bacteria that accountable 57.89 % of UTI; consistent results were recorded from Ethiopia [11], Iran [12]. This might be because gram-negative bacteria have a special structure that aids in adhering to uroepithelial cells and keeps the germs from being washed away by urine, allowing for proliferation and tissue invasion [13].

The major predominant etiological factor of UTIs was E. coli, estimated up to 44.45 % of isolation. This result is consent with the results from Kirkuk, Iraq [14], China [15] and Southwest Ethiopia [13]. The conceivable clarification for the rise isolation average of E. coli in findings' study might be due to the important plenty of E. coli in the rectal area, which in turn travels through the genitals to the urinary tract and causes UTI, as well as the fact that E. coli has a variety of significant virulence factors tailored for invasion and colonization of the urinary epithelium, such as S-fimbriae and P-fimbriae adherence factors that mediate the attachment [13].

The predominated isolates of incisional SSIs in current study were Gram-positive bacteria accountable 69.697%, consistent findings were reported from India [16] and Northeast Ethiopia [17] The findings of current study clarified that S. aureus and CoNS were the two most common isolates among the gram-positive isolates. This, in contrast, to study done by [5] Gram-negative bacteria were commonly associated with postoperative SSIs, with a predominance of Klebsiella spp. Within 30 to 90 days of the surgery, incisional SSIs are infections that develop at the surgical site. The infection may be minor, affecting only the skin and subcutaneous tissue, or it may be severe, affecting deeper tissues, organs, or even the implant itself. [18]. The patients incur higher costs due to longer hospitalizations, more nursing care, additional wound care, potential hospital admissions, and further surgical procedures. [19].

The medium of HiCrome Agar Base modified contain along with carbonaceous, nitrogenous, and vitamin B complex components, peptone supplies the required nutrients. To produce colored colonies, bacterial species particularly break the chromogenic mixture added to the medium. Suchlike Purple color for Escherichia coli, green color for Staphylococcus aureus, and blue color for Staphylococcus epidermidis [20].

This emphasizes that SSI-causing bacteria can differ between institutions. Regardless of the source of infection, S. aureus, a gram-positive bacterium, remains to be the main cause of SSI in patients in industrialized countries. [16]. The environment in the operating room, the effectiveness of the central sterile supply department, post-operative care, the type of surgery, and associated host factors are some of the variables that affect the incidence of SSIs. In addition, it is crucial to consider the elements that affect surgical wound healing and establish the risk of infection. [18].

5. Conclusions

According to the study's results, Gram-negative bacterial isolates have contributed significantly, E. coli was the most common pathogen associated with urinary tract infections in the current study. It can result from a prolonged hospital stay, substantial medical expenses, and a high rate of recurrence. Whereas the most predominant etiological agent of incisional SSIs was gram positive S. aureus.

6. Conflict of Interest

The authors affirm that they have no known financial or interpersonal conflicts that might have looked to have influenced the Manuscript presented in this study.

7. Acknowledgements

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References

1. Múñez, E., Ramos, A., Espejo, T.Á., Vaqué, J., Sánchez-Payá, J., Pastor, V., Asensio, A. Microbiología de las infecciones del sitio quirúrgico en pacientes intervenidos del tracto digestivo [Microbiology of surgical site infections in abdominal tract surgery patients]. Cir Esp. 89.9 (2011):606-12.
2. Saeed, A.M., Abdelmeguid, A.O., Khafagy, W.A. The Effect of Surgical Wound Infection on Postoperative Hospital Stay. The Egyptian Journal of Hospital Medicine. 90. 1 (2023):775-9.
3. P.S. Healthcare. National Healthcare Safety Network (NHSN) Overview.CDC (2023): 1-30.
4. Priya, B.B. A REVIEW ON URINARY TRACT INFECTIONS (UTI). 2019. PP:602-622.
5. Ali, K.M., Al-Jaff, B.M. Source and antibiotic susceptibility of gram-negative bacteria causing superficial incisional surgical site infections. International Journal of Surgery Open. 30 (2021): 100318.
6. Bhatia, R., and Ichhpujani, R. L., Essentials of Medical Microbiology. Jaypee Brothers Medical Publishers. 4 ed. (P) Ltd .India. 2008. PP: 1-489.
7. Owens, C.D., Stoessel, K. Surgical site infections: epidemiology, microbiology and prevention. J Hosp Infect. 2008;70 (Suppl 2):3-10.
8. Tille, P.M. Bailey & Scott's Diagnostic Microbiology. 13ed. Mosby, Inc., an affiliate of Elsevier Inc. (2014). PP: 1-900.
9. Chaurasia, R., & Jain, A. Self-Assessment & Review Microbiology Immunology. 4th ed. Jaypee Brothers Medical Publishers (P) Ltd. India. 2009. PP: 20-21.
10. Galar, A., Yuste, J.R., Espinosa, M., Guillén-Grima, F., Hernáez-Crespo, S. & Leiva J. "Clinical and economic impact of rapid reporting of bacterial identification and antimicrobial susceptibility results of the most frequently processed specimen types". Eur J Clin Microbiol Infect Dis. (2012). 31 (9): 2445-2452.
11. Gebretensaie, Y., Atnafu, A., Girma, S., Alemu, Y., Desta, K. Prevalence of Bacterial Urinary Tract Infection, Associated Risk Factors, and Antimicrobial Resistance Pattern in Addis Ababa, Ethiopia: A Cross-Sectional Study. Infection and Drug Resistance. (2023): 3041-3050.
12. Kheirkhah, D., Ghasemi, E., Derakhshan, M., Bagheri-Josheghani, S., Gilasi, H.R., Azadchehr, M.J., Sharif, M. Frequency of Urinary Tract Pathogens and the Pattern of Antibiotic Resistance among Iranian Children. International Journal of Pediatrics. 11.5 (2023): 17769-17780.
13. Teferi, S., Sahlemariam, Z., Mekonnen, M., Tamrat, R., Bekana, T., Adisu, Y., Darge, T. Uropathogenic bacterial profile and antibiotic susceptibility pattern of isolates among gynecological cases admitted to Jimma Medical Center, South West Ethiopia. Scientific Reports. 13.1 (2023): 7078.
14. Shahab, N.W., Ali, C.I., Salih, S.M. Isolation and Identification of bacteria causing urinary tract infections in children in Kirkuk city. Tikrit Journal of Pure Science. 22.2 (2017): 8-12.
15. Lu, J., Liu, X., Wei, Y., Yu, C., Zhao, J., Wang, L., Hu, Y., Wei, G. and Wu, S. Clinical and Microbial Etiology Characteristics in Pediatric Urinary Tract Infection. Front. Pediatr. 10(2022):844797.
16. Rao, S.V., Simon, P., Saldanha, E., Boloor, R., Jakribettu, R.P., Baliga, M.S. Surgical Site Infection in Head and Neck Cancer Patients: Observations from A Tertiary Care Hospital. South Asian Journal of Cancer. (2023):1-4.
17. Ali, A., Gebretsadik, D., Desta, K. Incidence of surgical site infection, bacterial isolate, and their antimicrobial susceptibility pattern among patients who underwent surgery at Dessie Comprehensive Specialized Hospital, Northeast Ethiopia. SAGE Open Medicine. 11 (2023): 20503121231172345

18. Trrisha, V., Shilpa, A., Rupakala, B.M., Lakshminarayana, S.A. A Study on Surgical Site Infections and Associated Risk Factors in General Surgeries at a Tertiary Care Hospital: A Cross-Sectional Study. EMJ Microbiol Infect Dis. 4.1(2023):109-116.
19. Misha, G., Chelkeba, L., Melaku, T. Bacterial profile and antimicrobial susceptibility patterns of isolates among patients diagnosed with surgical site infection at a tertiary teaching hospital in Ethiopia: a prospective cohort study. Annals of Clinical Microbiology and Antimicrobials. 20 (2021): 1-10.
20. Thangavel, A., Natarajan, M. & Moses, R. P. "Comparative Identification of Methicillin-Resistant *Staphylococcus aureus* (MRSA) based onamplification of mecA gene and Growth on MeReSa Agar and HiChrome MeReSa Agar". International Journal of Genetic Engineering and Biotechnology. ISSN 0974-3073. (2011). 2(2): 163-172.