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BACTERIOLOGICAL STUDY FOR POST - OPERATIVE SURGICAL SITE INFECTION AND MEROPENEM RESISTANCE IN BAQUBA TEACHING HOSPITAL

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ABSTRACT

Back ground: Postoperative SSI is the most common nosocomial infections in surgical patients. They lead to increased morbidity and mortality, prolonged hospital, and on average double the cost of medical care. **Objective:-** To assess of the bacteriological rate in the post - operative surgical site infection and meropenem resistant in Baquba teaching hospital. **Materials and Methods:** This study was done in the Baquba teaching hospital in Diyala province for the period from November 2017 to June 2018. 80 swabs were taken from different surgical site infection included:- Wound infection, Burn infection, Diabetic foot infection, Blast injury, Abdominal surgery, Testicular abscess, Protectomy, Cystectomy, Splenectomy, Breast surgery, Appendectomy, Hysterectomy, Colorectomy, Oophorectomy and others surgery. Swabs were taken cultured on different culture media and submitted to a serial of different biochemical tests for the diagnosis of type of bacteria. **Results:** In this study, 80 swabs were taken from different surgical site infections. The result showed that the higher rate of infection in wound infection was 16(20.0%), 15(18.8%) burn infection, 12(15.0%) diabetic foot infection, 7(8.8) blast injury, 5(6.2%) abdominal surgery and 3(3.8%) testicular abscess. The infection in males was (60%) more than females was (40%) in all types of surgery. The result also showed was 48 (60.0%) swabs show positive results for bacterial growth as single and mixed isolate, and 32(40.0%) were negative (no growth). The result also showed that the higher frequency rate of bacterial isolate from all type of surgery was 16(20.0%) *Staphylococcus aureus*, 13(16.2%) *Acinetobacter.Spp* and 10(12.5%) *E.coli*. The total rate of sensitive bacterial isolate was 28(58.3%) compared with resistant bacterial isolate was 18(37.5%) and 2(4.2%) one type resistant and other sensitive. **Conclusion**: There was predominance of Gram negative from SSIs, with *Staphylococcus aureus* being the most common isolates. The present study also found *Acinetobacter baumannii*, *Staphylococcus aureus* and *E.coli* were the most resistant microorganism to meropenem drug in Baquba Teaching Hospital.

KEYWORDS: Post-operative SSI, *Staphylococcus aureus*, *Acinetobacter baumannii*, Meropenem resistant.

INTRODUCTION

Surgical site infection is defined as an infection that occur within 30 days of the operation if no implant is left in place (or within 1 year if an implant is left in place after the procedure) and affecting either incision or deep tissues at the operation site.[1] These infections may be superficial or deep incisional infection or infections involving organ or body space.[2] Postoperative SSI is the most common nosocomial infections in surgical patients. They lead to increased morbidity and mortality, prolonged hospital, and on average double the cost of medical care.[3] There has been advance in surgical site infection control practices which include improved operating room ventilation, sterilization methods, use of barriers, surgical technique and availability of antimicrobial prophylaxis.[4] These SSIs remain common causes of morbidity and mortality due to emergence of antimicrobial resistant pathogenic bacteria. This is partly contributed by inappropriate use of surgical antimicrobial prophylaxis. Surgical site infections can be reduced by appropriate use of surgical antimicrobial prophylaxis.[5] Approximately 30-50% of the antibiotic use in hospitals is now for surgical prophylaxis and between 30-90% of this prophylaxis is inappropriate.[6] This inappropriate use increases selection pressure favoring emergence of pathogenic drug resistant bacteria.[7] In spite of the new antibiotics available today, surgical site infection still remains a threat due to secondary bacterial contamination and widespread use of prophylactic antibiotics that lead to the emergence of multi-drug resistant bacteria.[8] An infected wound can prolong hospitalization by 5 to 20 days and subsequently increase medical costs.[9] Currently, in the United States alone, an estimated 27 million surgical procedures are

performed each year.[10] The National Nosocomial Infection Surveillance System (NNISS) established in 1970, monitors reported trends in nosocomial infections in the US acute care hospitals. Based on these reports, surgical site infections (SSI's) are the most frequently reported nosocomial infections, accounting for 14% to 16% of all nosocomial infections among hospitalized patients.[11] The recent English Nosocomial Infection National Surveillance Scheme (NINSS) reported that the overall incidence of SSI's was 4.3% of all surgical operations, of which 25% were serious deep or organ/ space infections.[12]

MATERIALS AND METHODS

This study was done in the Baquba teaching hospital in Diyala province for the period from November 2017 to June 2018. 80 swabs were taken from different surgical site infection included:- wound infection, burn infection, diabetic foot infection, blast injury, abdominal surgery, testicular abscess, Protectomy, Cystectomy, Splenectomy, Breast surgery, Appendectomy, Hysterectomy, Colorectomy, Oophorectomy and others surgery. Swabs were taken cultured on different culture media and submitted to a serial of different biochemical tests for the diagnosis of type of bacteria.[13,14] And the cultures were tested for antibiotics sensitive Meropenem by using Kirby-Bauer disk method to evaluate their activity.

RESULTS

In this study, 80 swabs were taken from different surgical site infections. The result showed that the higher rate of infection in wound infection was 16(20.0%), 15(18.8%) burn infection, 12(15.0%) diabetic foot infection, 7(8.8) blast injury, 5(6.2%) abdominal surgery and 3(3.8%) testicular abscess. The infection in males was (60%) more than females was (40%) in all types of surgery Table (1). The result also showed was 48 (60.0%) swabs show positive results for bacterial growth as single and mixed isolate, and 32(40.0%) were negative (no growth). the results was revealed that the number of *Staphylococcus aureus* was 1(6.2%) in wound infection, 4(26.7%) burn infection, 6(50.0%) diabetic foot, 1(14.3%) blast injury, 2(40.0%) abdominal surgery and 2(9.1%) in others cases within type of surgery. The results of the present study showed that the number of *Acinetobacter. Spp* was 3(18.8%) in wound infection, 4(26.7%) burn infection, 2(16.7%) diabetic foot, 1(20.0%) abdominal surgery and 3(13.6%) in others cases within type of surgery. In the study the results showed that the number of *E.coli* was 2(12.5%) in wound infection, 1(6.7%) burn infection, 1(8.3%) diabetic foot, 2(28.6%) blast injury, 1(33.3%) testicular abscess and 3(13.6%) in others cases within type of surgery. The results revealed that the number of other type of bacteria was 3(18.8%) in wound infection, 1(8.3%) diabetic foot, 1(33.3%) testicular abscess and 4(18.2%) in others cases within type of surgery. So, the results showed no significant difference at ($p \leq 0.05$) in Table (2). The result showed that the number of sensitive bacterial isolate was 12(42.9%) *Staphylococcus aureus*, 5(17.9%) *Acinetobacter.Spp*, 6(21.4%) *E.coli* and 5(17.9%) others within sensitive and resistant. While the result showed that the number of resistant bacterial isolate was 4(22.2%) *Staphylococcus aureus*, 8(44.4%) *Acinetobacter.Spp*, 4(22.2%) *E.coli* and 2(11.1%) others within sensitive and resistant. Also the result showed that the number of one type resistant and other sensitive was 2(100.0%) others bacterial isolate within sensitive and resistant. So, the results showed a high significant difference at ($p \leq 0.05$) in Table (3).

Table 1: Demographic statistical analysis for all study groups according to type of surgery and gender.

			Type of surgery							Total
			Wound infection	Burn infection	Diabetic foot	Blast injury	Abdominal surgery	Testicular abscess	Others**	
Gender	Male	Count	14	7	9	6	1	3	8	48
		Expected Count	9.6	9.0	7.2	4.2	3.0	1.8	13.2	48.0
		% within Gender	29.2%	14.6%	18.8%	12.5%	2.1%	6.2%	16.7%	100.0%
		% within Type of surgery	87.5%	46.7%	75.0%	85.7%	20.0%	100.0%	36.4%	60.0%
	Female	Count	2	8	3	1	4	0	14	32
		Expected Count	6.4	6.0	4.8	2.8	2.0	1.2	8.8	32.0
		% within Gender	6.2%	25.0%	9.4%	3.1%	12.5%	0.0%	43.8%	100.0%
		% within Type of surgery	12.5%	53.3%	25.0%	14.3%	80.0%	0.0%	63.6%	40.0%
Total		Count	16	15	12	7	5	3	22	80
		Expected Count	16.0	15.0	12.0	7.0	5.0	3.0	22.0	80.0
		% within Gender	20.0%	18.8%	15.0%	8.8%	6.2%	3.8%	27.5%	100.0%
		% within Type of surgery	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

***P value = 0.003**

**Others included: Others Male: Protectomy, Echinococcotomy, Vertebrate surgery, Cystectomy, Meningocele, Bed sore, Splenectomy, Breast surgery (1). Others Female: Appendectomy (2), Pelvis ulcers (2), Hysterectomy (2), Proctectomy, Echinococcotomy, Vertebrate surgery, Colorectomy, Hemorrhoidectomy, Partial colectomy, Oophorectomy, Thyroglossal cyst (1).

Table 2: Statistical variations to type of bacteria according to type of surgery.

			Type of bacteria					
			No growth	**Staphylococcus aureus**	**Acinetobacter Spp**	**E.coli**	**Others****	**Total**
Type of surgery	Wound infection	Count	7	1	3	2	3	16
		Expected Count	6.4	3.2	2.6	2.0	1.8	16.0
		% within Type of surgery	43.8%	6.2%	18.8%	12.5%	18.8%	100.0%
		% within Type of bacteria	21.9%	6.2%	23.1%	20.0%	33.3%	20.0%
	Burn infection	Count	6	4	4	1	0	15
		Expected Count	6.0	3.0	2.4	1.9	1.7	15.0
		% within Type of surgery	40.0%	26.7%	26.7%	6.7%	0.0%	100.0%
		% within Type of bacteria	18.8%	25.0%	30.8%	10.0%	0.0%	18.8%
	Diabetic foot	Count	2	6	2	1	1	12
		Expected Count	4.8	2.4	2.0	1.5	1.4	12.0
		% within Type of surgery	16.7%	50.0%	16.7%	8.3%	8.3%	100.0%
		% within Type of bacteria	6.2%	37.5%	15.4%	10.0%	11.1%	15.0%
	Blast injury	Count	4	1	0	2	0	7
		Expected Count	2.8	1.4	1.1	.9	.8	7.0
		% within Type of surgery	57.1%	14.3%	0.0%	28.6%	0.0%	100.0%
		% within Type of bacteria	12.5%	6.2%	0.0%	20.0%	0.0%	8.8%
	Abdominal surgery	Count	2	2	1	0	0	5
		Expected Count	2.0	1.0	.8	.6	.6	5.0
		% within Type of surgery	40.0%	40.0%	20.0%	0.0%	0.0%	100.0%
		% within Type of bacteria	6.2%	12.5%	7.7%	0.0%	0.0%	6.2%
	Testicular abscess	Count	1	0	0	1	1	3
		Expected Count	1.2	.6	.5	.4	.3	3.0
		% within Type of surgery	33.3%	0.0%	0.0%	33.3%	33.3%	100.0%
		% within Type of bacteria	3.1%	0.0%	0.0%	10.0%	11.1%	3.8%
	others	Count	10	2	3	3	4	22
		Expected Count	8.8	4.4	3.6	2.8	2.5	22.0
		% within Type of surgery	45.5%	9.1%	13.6%	13.6%	18.2%	100.0%
		% within Type of bacteria	31.2%	12.5%	23.1%	30.0%	44.4%	27.5%
Total		Count	32	16	13	10	9	80
		Expected Count	32.0	16.0	13.0	10.0	9.0	80.0
		% within Type of surgery	40.0%	20.0%	16.2%	12.5%	11.2%	100.0%
		% within Type of bacteria	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

***P value = 0.386**

**Other include: other male: *Streptococcus. Spp*, *Klebsiella. Spp* (2) and *Pseudomonas. Spp* (1). Other female: *Proteus. Spp* and *Acinetobacter.Spp*, *Proteus. Spp*, *Pantoea. Spp*, *E.coli* and *Acinetobacter.Spp* (1).

Table 3: Statistical variations to type of bacteria according to sensitive and resistant.

			Type of bacteria				
			Staphylococcus aureus	**Acinetobacter. Spp**	**E.coli**	**others**	**Total**
Sensitive and Resistance	Sensitive	Count	12	5	6	5	28
		Expected Count	9.3	7.6	5.8	5.3	28.0
		% within Sensitive and Resistance	42.9%	17.9	21.4%	17.9%	100.0%
		% within Type of bacteria	75.0%	38.5%	60.0%	55.6%	58.3%
	Resistant	Count	4	8	4	2	18
		Expected Count	6.0	4.9	3.8	3.4	18.0
		% within Sensitive and Resistance	22.2%	44.4%	22.2%	11.1%	100.0%
		% within Type of bacteria	25.0%	61.5%	40.0%	22.2%	37.5%
	one type resistant and other sensitive	Count	0	0	0	2	2
		Expected Count	.7	.5	.4	.4	2.0
		% within Sensitive and Resistance	0.0%	0.0%	0.0%	100.0%	100.0%
		% within Type of bacteria	0.0%	0.0%	0.0%	22.2%	4.2%
Total		Count	16	13	10	9	48
		Expected Count	16.0	13.0	10.0	9.0	48.0
		% within Sensitive and Resistance	33.3%	27.1%	20.8%	18.8%	100.0%
		% within Type of bacteria	100.0%	100.0%	100.0%	100.0%	100.0%

***P value = 0.035**

DISCUSSION

In the current study, 48 bacterial isolates were investigated to determine their types and antimicrobial susceptibility pattern. Our finding demonstrates the predominance of gram negative bacterial isolates in SSIs, *S. aureus* being the commonest isolated organism followed by, *E.coli*, *Streptococcus. Spp*, *Klebsiella. Spp*, *Proteus. Spp*, *Pseudomonas. Spp*, *Pantoea. Spp*. This pattern of organisms causing SSIs in the current study agrees with a previous study.[15,16,17] This pattern of organisms causing SSIs in the current study is in contrast

with a previous study from the same study setting which reported *Acinetobacter.Spp* as the most common SSI bacterial pathogen.[18] The possible reason for variation in these studies could be attributed to differences in the populations investigated; diversity of surgical procedures performed on the study participants, as well as timing of specimen collections. This difference could also be attributed to differences in geographical locations and standards of hygiene. In the present study, the majority of the isolates were obtained from patients who were already on antimicrobial treatment. This could have led to the low recovery of antimicrobial susceptible Gram positive pathogens. Multiple factors could have contributed to the high proportion of infections due to Gram negative pathogens in this study. A review reported that hands of health care workers and patients can play a role in the transfer of Gram negative bacteria during cross infection.[19] Regarding the frequency of the isolation of organisms in different types of infection in the present study, *Acinetobacter.Spp* was the most common isolate from wound infection types, while *S.aureus* and *Acinetobacter.Spp* were among the most common isolates from burn infection types. The results obtained from this study showed that the *S.aureus* was the most common isolate from diabetic foot infection. The results also showed that the *E.coli* and *Acinetobacter.Spp* were among the most common isolates from other cases infection type. These findings suggest that the etiologic agents of SSIs depend on where the procedures are performed and whether skin was incised or gastrointestinal tract was opened. When gastrointestinal tract is opened, organisms usually include aerobic Gram negative rods. In the present study, anaerobic organisms were not isolated from culture despite the measures taken to recover such organisms from surgical wounds. The probable reasons could be delayed in inoculation of the swabs into the fresh blood agar media; some patients received prophylactic metronidazole which kills anaerobes and the use of dry cotton wool swabs for specimen collection. A previous study documented that the use of dry swabs for collection of specimens could hinder the isolation of the anaerobes.[20] Our investigations found that, the majority of isolates Acinetobacter baumannii were highly resistant to meropenem, followed by S. aureus, E.coli and Klebsiella. Spp. These findings concurred in a previous study done in Palestine which reported high resistance rates of Acinetobacter baumannii.[21] This results may be due to spread of a single A. baumannii isolate as a source of a nosocomial outbreak is often linked to contamination of respiratory equipment and transmission via the hands of hospital staff.[22] Numerous studies showed that the hospital environment is a preferential setting in which A.baumannii isolates can persist and develop. A. baumannii seems to have unique characteristics among nosocomial Gram-negative bacteria that enhance its environmental persistence. The possibility that the community represents a reservoir for A. baumannii was evaluated by analyzing and comparing isolates recovered from patients in two hospitals in New York, USA, with isolates recovered from the hands of individuals in the community.[23] A. baumannii is known to have the propensity to develop antibiotic resistance rapidly.[24] This pattern of organisms causing resistance in the current study is in contrast with previous study from north India which reported pseudomonas. Spp as the most common causing resistant for meropenem.[25] This result may be due to different geographical study or the timing of study.

CONCLUSION

There was predominance of Gram negative from SSIs, with *Staphylococcus aureus* being the most common isolates. The present study also found *Acinetobacter baumannii*, *Staphylococcus aureus* and *E.coli* were the most resistant microorganism to meropenem drug in Baquba Teaching Hospital.

REFERENCES

1. Jasim HH, Sulaiman SAS, Khan AH. and *et al*. Incidence and Risk Factors of Surgical Site Infection Among Patients Undergoing Cesarean Section. Clinical Medicine Insights: Therapeutics, 2017; 9.
2. Rao BH, Chakravarthy KS. The study on post-operative wound infections at Vizianagaram in Andhra Pradesh, India. International Journal of Research in Medical Sciences, 2016; 4(12): 5351-5.
3. Al-Abbas AK. Aerobic bacteria isolation from post-caesarean surgical site and their antimicrobial sensitivity pattern in Karbala city, Iraq. Iraq Medical Journal, 2017; 1(4).
4. Cheng K, Li J, Kong Q. and *et al*. Risk factors for surgical site infection in a teaching hospital: a prospective study of 1,138 patients. Patient preference and adherence, 2015; 9: 1171.
5. Tariq A, Ali H, Zafar F, Hameed K, Sial AA, Salim S. and Naqvi GR. Surgical site infection; Frequency of clinical isolates involved sensitivity and resistivity pattern estimate. Professional Medical Journal, 2017; 24(7).
6. Afzal Khan AK, MirshAd PV. and MohAMMed rAfiuddin rAshed GB. A study on the usage pattern of antimicrobial agents for the prevention of surgical site infections (SSIs) in a tertiary care teaching hospital. Journal of clinical and diagnostic research. JCDR, 2013; 7(4): 671.
7. Al-Momany NH, Al-Bakri AG, Makahleh ZM. and Wazaify MM. Adherence to international antimicrobial prophylaxis guidelines in cardiac surgery: a Jordanian study demonstrates need for quality improvement. Journal of Managed Care Pharmacy, 2009; 15(3): 262-71.
8. Etok CA, Edem EN. and Ochang E. A etiology and antimicrobial studies of surgical wound infections in University of Uyo Teaching Hospital (UUTH) Uyo, Akwa Ibom State, Nigeria. Niger Open Access Sci Rep., 2012; 1(7): 1-5.
9. Negi V, Pal S, Juyal D, Sharma MK. and Sharma N. Bacteriological profile of surgical site infections and

their antibiogram: A study from resource constrained rural setting of Uttarakhand State, India. Journal of clinical and diagnostic research: JCDR, 2015; 9(10): 17.
10. Faruquzzaman HS, Mazumder S. Surgical site infections in relation to the timing of shaving among the gastrointestinal emergency patients through the midline incisions-a randomized controlled clinical trial. J Med Microbiol Diagn, 2012; 1: 111.
11. Valecha SM, Saswade MN. An original research paper on incidence and risk factors for surgical site infections following major abdominal surgeries in obstetrics and gynecology. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, 2017; 6(5): 1859-63.
12. Jagiasi JD, Ali S, Prakash Ch, Ganesh Y. and Amit Y. Prevalence of Surgical Site Infections in Clean Orthopedic Practice With Implants. Int J Med Res Prof, 2017; 3(4): 184-88.
13. Collee JG, Fraser AG, Marmon BP. and Simmons A. (1996). Practical medical microbiology. 14th-ed. Churchill Livingston, U.S.A.
14. Barrow GI, Stephan RK. Rowan and Spiel manual for the identification of medical bacterial 3ph ed. Cambridge: Cambridge University Press, 1993.
15. Khorvash F, Mostafavizadeh K, Mobasherizadeh S. and *et al*. Antimicrobial susceptibility pattern of microorganisms involved in the pathogenesis of surgical site infection (SSI); A 1 year of surveillance. Pak J Biol Sci, 2008; 11(15): 1940-4.
16. Mawalla B, Mshana SE, Chalya PL. and *et al*. Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania. BMC surgery, 2011; 11(1): 21.
17. Andhoga J, Macharia AG, Maikuma IR. and *et al*. Aerobic pathogenic bacteria in post-operative wounds at Moi Teaching and Referral Hospital. East African medical journal, 2002; 79(12): 640-4.
18. Roohi S, Lubna S, Saba W. and *et al*. Multidrug Resistant Acinetobacter Infection in Surgical Intensive Care Unit in a Tertiary Care Center in North India. International Journal of Contemporary Medical Research, 2017; 4(3).
19. Gould D, Chamberlain A. Gram-negative bacteria. The challenge of preventing cross-infection in hospital wards: a review of the literature. J Clin Nurs, 1994; 3: 339-45.
20. Sule AM, Thanni L, Sule Odu AO. and Olusanya O. Bacterial pathogens associated with infected wounds in Ogun State University Teaching Hospital, Sagamu, Nigeria. Af J of Clinical and Experimental Microbiology, 2002; 3: 13-16.
21. Handal R, Qunibi L, Sahouri I, Juhari M, Dawodi R, Marzouqa H. and Hindiyeh M. Characterization of carbapenem-resistant Acinetobacter baumannii strains isolated from hospitalized patients in Palestine. International journal of microbiology. (2017) 2017.
22. Cisneros JM, Rodríguez-Baño J. Nosocomial bacteremia due to Acinetobacter baumannii: epidemiology, clinical features and treatment. Clinical Microbiology and Infection, 2002; 8(11): 687-693.
23. Zeana C, Larson E, Sahni J, Baguya SJ, Wu F. and Della-Latta P. The epidemiology of multidrug-resistant Acinetobacter baumannii: does the community represent a reservoir Infect Control Hosp Epidemiol, 2003; 24: 275–279.
24. Bergogne-Be`re`zin E, Towner KJ. Acinetobacter spp. as nosocomial pathogens: microbiological, clinical, and epidemiological features. Clin. Microbiol. Rev, 1996; 9: 148–165.
25. Gupta E, Mohanty S, Sood S, Dhawan B, Das BK. and Kapil A. Emerging resistance to carbapenems in a tertiary care hospital in north India. Indian Journal of Medical Research, 2006; 124(1): 95.