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ANTIBIOTIC RESISTANCE IN NECK SPACE INFECTION

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Abstract

Acute neck space infection is an important cause of admission in otolaryngology wards. Antibiotics and surgical maneuvers are the modes of treatment of this serious illness. Antibiotic resistance increases the morbidity and mortality of this condition. Many antibiotics now have little use due to resistance. Multiple factors are involved in the development of resistance. Selection of proper antibiotic at the initial stage of treatment plays a key role in the outcome. This paper discussed pattern of antibiotic resistance in 260 patients in Chittagong Medical College Hospital.

Introduction

Acute neck space infection is an important cause of hospital admission in otolarygology wards all over the world specially in developing countries. Systemic antibiotics and surgical measures are the remedies of this condition[1]. In the pre-antibiotic era, morbidity and mortality due to acute neck space infection were quite high. Frequently multiple organisms are involved here. Invention of antibiotics and aseptic surgical techniques dramatically changed the outcome[2]. But within few years of invention of antibiotics, there was emergence of antibiotic resistance. By the 1990s various reports had signalled the danger of excessive or inappropriate use of antibiotics in clinical medicine[3]. Many antibiotics once used with high clinical success, now have limited use due to resistance. Indiscriminate use of antibiotics plays a big role along with other factors like over crowding, poor sanitation, lack of necessary drug laws etc in developing resistance[4]. Research to develop newer antibiotics in overcoming the resistance is going on, but it needs time and big investment. Today, antibiotic resistance is a big hurdle in combating infections. It prolongs the debility, increases the mortality with consequent increase in health care cost. Ideally antimicrobial therapy should be started according to drug sensitivity report. But in many cases initial blind antibiotic therapy has to be started as it needs a few days to get the result of drug sensitivity. Initial blind therapy may fail due to resistance with consequent increase in morbidity and mortality. Facilities for detecting the organisms and drug sensitivity are not available at every corner of our country, which is a big impediment in the management field. Delay in detecting appropriate antibiotic increases the sufferings of the patient. As the multidrug resistant organisms are increasingly emerging, the selection of proper antibiotic at the early stage of neck space infection plays a key role in the outcome.

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Aims and objectives

The aims of the study are-to find out the bacteriological pattern, their drug resistance and to formulate a treatment option in initial blind therapy of neck space infection.

Materials and methods

260 adult patients of both sexes with the diagnosis of neck space infection were admitted in the Department of Otolaryngology and Head Neck Surgery, Chittagong medical College Hospital from January 2004 to December 2006, included in the study. Patients with abscess formation in relation to middle ear, superficial skin infection and peritonsillar abscess were excluded from the study. Diagnosis was made by history and clinical examination. A full blood count, routine urine examination, blood glucose and urea were estimated in all cases. X-ray and ultrasonography were done in selective patients. Pus was obtained either by incision drainage or aspiration for culture. A parenteral combination of Cephradine, Flucloxacillin and Metronidazole was used as initial blind therapy which was changed according to lab report later on.

Results

260 patients were included in the study. Among them 164 were male and rests were female. (Table I)

Table I : Sex distribution (n=260)

Male	Female	M : F
164	96	1.7 : 1

In 260 patients, 245 culture reports were positive and 15 cultures revealed no growth. (Table II)

Table II : Culture results (n=260)

Report	Number	%
Culture positive	245	94%
No growth	15	6%

In this series, 245 strains of bacteria were detected from culture positive specimens. (Table III)

Table III : Frequency of organisms (n=245)

Bacteria	Number	%
Staphylococcus	102	41%
E. coli	81	33%
Streptococci	26	11%
Klebsiella	15	6%
Proteus	12	5%
Pseudomonas	9	4%

Antibiotic sensitivity and resistance pattern of the bacteria summarized in Table IV.

Table IV : Antibiotic sensitivity and resistance pattern (S- sensitive, R- resistant)

	Staphylo. n = 102		E coli n = 81		Strepto. n = 26		Klebs. n = 15		Proteus n = 12		Pseudom n = 9	
	S	R	S	R	S	R	S	R	S	R	S	R
Amoxicillin	04	98	21	60	09	17	00	15	00	12	00	09
Cloxacillin	77	25	06	75	14	12	00	15	00	12	00	09
Cephradine	41	61	44	37	19	07	07	08	04	08	00	09
Ceftazidime	63	39	61	20	22	04	12	03	07	05	08	01
Ceftriaxone	59	43	56	25	20	06	11	04	09	03	00	09
Gentamycin	71	31	64	17	10	16	12	03	09	03	08	01
Ciprofloxacin	58	44	59	22	12	14	12	03	10	02	07	02
Chloramphenicol	06	96	05	76	03	23	00	15	00	12	00	09
Co-trimoxazole	00	102	14	67	08	18	02	13	00	12	00	09
Doxicycline	00	102	08	73	00	26	00	15	00	12	00	09

The most frequent strain is Staphylococcus and it showed highest sensitivity in Cloxacillin followed by Gentamicin and Ceftazidime but it is highly resistant to other drugs. E coli is the second highest number in the series and it showed highest sensitivity in Gentamicin followed by Ceftazidime, Ceftriaxone and Ciprofloxacin where as it is highly resistant to other drugs. Streptococci are sensitive in Cephalosporins but highly resistant to others. Other gram-ve organisms highly sensitive to Ceftazidime, Gentamicin and Ciprofloxacin but resistant to other drugs.

Discussion

Treatment of neck space infection remains a challenge to the surgeons over the centuries. Newer imaging modalities and surgical techniques greatly improve the outcome but drug resistance appears as a new threat in the management field. Numerous studies showed the evidence of increasing number of multi drug resistant bacteria which bears great concern to the developing countries as because of increasing morbidity, mortality and health care cost5. The mechanisms by which microorganisms might exhibit resistance to antibiotics are - i) Microorganisms produce enzymes that destroy the active drug ii) Change their permeability to the drug iii) Develop an altered structural target for the drug iv) Develop an altered metabolic pathway that bypasses the reaction inhibited by the drug v) Develop an altered enzyme that can still perform its metabolic function which is much less affected by the drug. Organisms acquire resistance by either nongenetically or genetically by spontaneous mutation or by plasmid transfer[6].

Staphylococcus is the commomest organism is this series. It showed good sensitivity to Cloxacillin followed by Gentamycin and Ceftazidime. It is one of the major resistant pathogen all over the world. It was the first bacterium in which penicillin resistance was found in 1947, just four years after the drug started being mass-produced. Methicillin was then the antibiotic of choice, but has since been replaced by Cloxacillin due to significant kidney toxicity. MRSA (methicillin-resistant Staphylococcus aureus) is now quite common in hospital acquared infections. MRSA was responsible for 37% of fatal cases of blood poisoning in the UK in 1999, up from 4% in 1991. Community-acquired MRSA has now emerged as rapidly progressive fatal diseases including necrotizing pneumonia, severe sepsis and

necrotizing fasciitis[7]. Methicillin-resistant Staphylococcus aureus (MRSA) is the most frequently identified antimicrobial drug-resistant pathogen in US hospitals and endemic urban areas[8]. Half of all S. aureus infections in the US are resistant to penicillin, methicillin, tetracycline and erythromycin. This left vancomycin as the only effective agent available at the time. However, Vancomycin-resistant Staphylococcus aureus appeared in the United States in 2002. A new class of antibiotics, oxazolidinones, became available in the 1990s, and the first commercially available oxazolidinone, linezolid, is comparable to vancomycin in effectiveness against MRSA. Linezolid-resistance in Staphylococcus aureus was reported in 2003[9].

E. coli, a gram –ve enteric organism and a member of normal intestinal flora sometimes found in small number in upper respiratory tract as a part of normal flora. The bacteria become pathogenic when they reach the tissues outside of their normal habitat. They are the second commonest organisms in this study. It showed good sensitivity to gentamycin, cephalosporins and ciprofloxacin. Apart from neck space infection, they commony cause urinary tract infection, diarrhoea, biliary tract infection, meningitis, sepsis etc. Neonates are highly susceptible to E coli sepsis as they lack IgM antibodies[10]. Resistance to fluoroquinolones in E coli has increased sharply despite a reduction in prescribing[5].

Streptococci are a heterogenous group of bacteria securing the third position in this study showing good response on cephalosporins. Among them _ haemolytic Group A Streptococci are sensitive to penicillins and cephalosporins where as others vary in susceptibility to antibiotcs[11]. Strains of S. pyogenes resistant to macrolide antibiotics have emerged[12]. Invasive Group A Streptococci may cause toxic shock syndrome, necrotizing fasciitis, myositis, multiorgan failure. Early treatment may reduce the risk of death from invasive group A streptococcal disease. However, even the best medical care does not prevent death in every case. For those with very severe illness, supportive care in an intensive care unit may be needed. For persons with necrotizing fasciitis, surgery often is needed to remove damaged tissue[13].

Klebsiella and Proteus were found in lesser number in this study. They are also enteric gram –ve rods and pathogenesis of disease caused by these organisms are similar to that of E coli. Cephalosporins, aminoglycosides and quinolones have marked antibacterial activity against the enterics but variation in susceptibility is quite high. Multiple drug resistance in gram negative enterics is common and is under the control of transmissible plasmids. Such resistant strains are thought to originate from patients' gut flora[3]. There are reports of significant increase in resistance of gram –ve enterics to Ciprofloxacin[14].

Pseudomonas is a highly virulent opportunistic pathogen. One of the most worrisome characteristics of Pseudomonas consists in its low antibiotic susceptibility. This low susceptibility is attributable to a concerted action of multidrug efflux pumps with chromosomally-encoded antibiotic resistance genes and the low permeability of the bacterial cellular envelopes and extended _ lactamase activity. Besides intrinsic resistance, Pseudomonas easily develops acquired resistance either by mutation or by the horizontal gene transfer of antibiotic resistance determinants[15]. Pseudomonas is the least frequent finding in this study. It is sensitive to ceftazidime, gentamycin and ciprofloxacin where as resistant to all other drugs.

Neck space infections are frequently polymicrobial which is well supported by this series[2]. So a combination of antimicrobials is preferred in combating infection. This study shows combination of a cephalosporin with gentamycin or ciprofloxacin is a good choice as an initial blind therapy which is sensitive to most bacteria. In addition metronidazole may be added where anaerobic infection is suspected. This combination can be changed later on according to C/S report.

Apart from bacterial factors, other factors like inadequate health services, inadequate drug supplies, non-adherence to treatment strategies, unnecessary prescribing antibiotics and poor drug quality all favor the emergence of resistance[4,16]. Poverty and inadequate access to drugs continue to be a major force in the development of resistance. In many developing nations quality drugs are freely available to those who can afford them. So the poor patients are forced to buy poor quality medicines or adopt incomplete treatment courses. Resistance flourishes wherever antibiotics are abused, misused and dispensed at levels lower than treatment guidelines dictate. This means that instead of wiping out the

infection altogether, medications kill only non-resistant organisms – leaving their tougher counterparts to replicate and spread resistance genes[4].

Gradual rise of antibiotic resistance is one of the important public health issue all over the world. It can be minimized by avoidance of indiscriminate use of antibiotics, strict adherence to treatment guidelines, using antimicrobial combination in appropriate cases, constant monitoring resistance pattern in hospitals and in the community, good infection control in hospitals and adequate funding for developing new effective drugs. As the antibiotic resistance has no geographical barrier, a concerted action by the governments, medical professionals, pharmaceutical industries, WHO and different health related bodies is essential in achieving the goa[14,17].

References

1. Bottin R, Marioni G, Rinaldi R, Boninsegna M, Salvadori L, Staffieri A. Deep neck infection: a present day complication- A retrospective review of 83 cases (1998-2001). Eur Arch Otorhinolaryngol 2003;260(10):576-579.
2. Meher R, Jain A, Sabharwal A, Gupta B, Singh I, Agarwal A K. Deep neck abscess: a prospective study of 54 cases. J laryngol Otol 2005;119(4):299-302.
3. Soulsby EJ. Resistance to antimicrobials in humans and animals. BMJ 2005;331:1219-1220
4. WHO Bulletin. Antimicrobial resistance, January 2002: www.who.int/en
5. Livermore DM. Minimising antibiotic resistance. Lancet Infect Dis 2005;5 (11): 668 - 670.
6. Brooks GF. Antimicrobial chemotherapy. In: Brooks GF, Butel JS, Morse SA (Editors). Jawetz's Medical Microbiology. 23rd ed. Boston; Mc Graw Hill:2004; 164-165.
7. Boyle VS, Daum RS. Community acquired methicillin resistant Staphylococcus aureus: the role of Panton-Valentine leukocidin. Lab Invest 2007;87(1):3-9.
8. Maree CL, Daum RS, Boyle-Vavra S, Matayoshi K, Miller LG. Community-associated methicillin-resistant Staphylococcus aureus isolates causing healthcare-associated infections. Emerging Infect Dis 2007. 13(2):236–242.
9. Antibiotic resistance, Wikipedia:http: //en.wikipedia.org/wiki/Antibiotic_resistance
10. Brooks G F. Enteric gram negative rods (Enterobacteriaceae). In: Brooks G F, Butel J S, Morse S A (Editors). Jawetz's Medical Microbiology. 23rd ed. Boston; Mc Graw Hill:2004; 248-254.
11. Brooks G F. The Streptococci. In: Brooks G F, Butel J S, Morse S A (Editors). Jawetz's Medical Microbiology. 23rd ed. Boston; Mc Graw Hill:2004; 231-240.
12. Albrich WC, Monnet DL, Harbarth S. Antibiotic selection pressure and resistance in Streptococcus pneumonaie and Streptococcus pyogenes. Emerging Infect Dis 2004;10(3):514-517
13. Division of Bacterial and Mycotic Diseases, Centers for Disease Control and Prevention, USA. Group A Streptococcal Disease (strep throat, necrotizing fasciitis, impetigo) – FAQ, October, 2005 :www.cdc.gov/ ncidod / dbmd / diseaseinfo / groupastreptococcal_g
14. Livermore DM, James D, Reacher M, Graham C, Nichols T, Stephens P, Johnson AP, George RC. Trends in fluroquinolone (ciprofloxacin) resistance in Enterobacteriaceae from bacteremias, England and Wales, 1990-1999. Emerging Infect Dis 2002;8(5):473-478.
15. Fajardo A, Martinez JL. Antibiotic resistance in Pseudomonas. In Cornelis P (Editor). Pseudomonas: Genomics and Molecular Biology, 1st ed., Norfolk; Caister Academic Press. 2008; Chapter8.
16. Williams JD, Sefton AM. The prevention of antibiotic resistance during treatment. Infection. 1999;27 Suppl 2:S 29-31.
17. Richard W. The relentless rise of resistance? J Antimicrob Chemotherap 2004; 54 (2) : 306-310.