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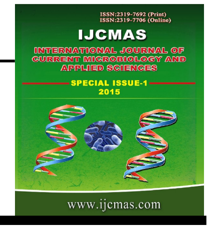

Original Research Article

Infected Surgical Drain, An Important Complication: Thinking outside the Box

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Keywords

Drain,
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A B S T R A C T

A surgical drain is a tube used to remove pus, blood or other fluids from a wound which may accumulate and become a focus of infection. Presence of drain itself increases the risk of infection and complication. The study was conducted in the Department of Microbiology, Jawaharlal Nehru medical College and Hospital, AMU Aligarh (India) over one year period. The aim of present study was to analyze the bacteriological profile and antimicrobial sensitivity pattern of bacterial isolates associated with surgical drain infection. Total 539 (60.8%) samples were collected out of which 315(58.4%) showed bacterial growth. The predominant bacterial isolates were *Escherichia coli* 121(51.7%) followed by *Citrobacter species* 66(28.2%) and *Pseudomonas species* 17(7.3%). Imipenem was found to be the most effective drug for Gram negative bacilli while vancomycin most effective for Gram positive cocci.

Introduction

Drainage of body cavities has been practiced in medicine for a long time (Petrowsky H. *et al.*, 2004). Historical reports of drainage of chest empyema and ascites go back to the Hippocratic era (Robinson, 1986). A surgical drain is a tube frequently used to remove excess fluid and blood from wounds or body spaces (Jain et al., 2013). These devices have also been used to decrease local edema, lessen the potential for hematoma or seroma formation, and to aid in the efflux of infection. However, the role of postoperative surgical drains in clean, elective cases has not been firmly established (Gaines and Dunbar, 2008). However, abdominal drainage has always been a subject of controversy, practiced in confusion and subjected to local dogmas (Moshe Schein, 2008). Drains have been implicated in several clinical studies as a contributing factor to the development of infection and other complications. The mechanism by which drains enhance sepsis may be several. The drain provides a route by which bacteria can gain access to the tissues. Another explanation is that drains are foreign bodies that damage tissues defences and thereby invite infection.

Despite these complications drains continue to be an important aspect of the management of surgical patients. In fact, most studies fail to show a statistical difference in outcome between drained and undrained patients (Bacha et al., 2009). Because of the potential function of abdominal drains to signal early complications, such as postoperative hemorrhage and leakage of enteric suture lines, prophylactic drainage has gained wide acceptance as a useful method to prevent complications after gastrointestinal (GI) surgery (Dougherty HH *et al.*, 1992). Enormous data is available regarding the complications and use of drains in various surgical practices (Bacha et al., 2009; Hubbard et al., 1979; Nomura et al., 1998). Studies have shown that bacteria do migrate via the drain into the interior (Paul et al., 1972). On the pros side, drain aspirate can serve as a useful marker of early infection which could prompt remedial steps. The aim of present study was to determine the prevalence and antimicrobial sensitivity pattern of bacteria isolated from abdominal surgical drain samples.

Material and Methods

Study design

The present retrospective study was conducted in the Department of Microbiology, Jawaharlal Nehru Medical College and Hospital, AMU Aligarh; relevant information pertaining to age, sex, culture and sensitivity were collected from records for a period of 1 year (November 2013–October 2014). All the samples were sent from general surgery department from patients developing infection after abdominal surgery.

Sample collection

Samples from surgical drains were collected aseptically into sterile containers from those patients who develop sign or symptoms of infection after abdominal surgery.

Direct microscopic examination

Gram staining was done to look for the presence of pus cells and microorganism.

Bacterial identification

Samples were cultured on 5% sheep blood agar, MacConky agar, and chocolate agar and incubated at $37^{O}C$ for 24 hours. Bacterial species identification was done by cultural characteristic, Gram staining and standard biochemicals (Collee *et al.*, 2006).

Antimicrobial Susceptibility Testing

Antibiotic susceptibility testing was performed by Kirby-Bauer's disk diffusion method on Muller-Hinton agar (Hi Media, Mumbai, India) as per the Clinical Laboratory Standards Institute guidelines (CLSI, 2014) using commercially available antibiotic discs from HiMedia (Mumbai, India).

The antibiotics used for gram negative bacilli: amikacin (30µg), gentamicin (10µg), ceftriaxone (30µg), cefepime (30µg),, cefixime (5µg) cefoperazone (75µg), cefoperazone-sulbactum (75/75µg), ofloxacin (5µg), imipenem (10µg), piperacillin (100µg), piperacillin + tazobactum (100/10µg), ceftazidime (30µg), tobramycin (10µg).

The antibiotics used for gram positive cocci

Among the gram positive cocci the antibioticss tested for Staphylococcal species were amikacin (30µg), gentamicin (10µg), ofloxacin (5µg), cefaclor (30µg), erythromycin (15µg), cefazolin (30µg), oxacillin(1µg), and vancomycin (30µg). For

Enterococcus species the antibiotics tested were azithromycin (15µg), amoxicillin (30µg), gentamicin (10µg), erythromycin (15µg), high content gentamicin (120µg), high content streptomycin (300µg), and vancomycin (30µg).

S. aureus ATCC 25923, *E. coli* ATCC 25922 and *P. aeruginosa* 25873 were used as control strains

Detection of MRSA

MRSA was detected by oxacillin disc diffusion test by using oxacillin disc (1µg).

Detection of HLAR

High content gentamicin (120µg) and high content streptomycin (300µg) disc were used for the detection of HLAR in *Enterococci*.

Detection of ESBL:

Screening of possible ESBL production was done by using ceftriaxone (30 µg) and cefoperazone (75 µg). Those isolates with zone diameters less than 25 mm for ceftriaxone and less than 22 mm for cefoperazone were subsequently confirmed for ESBL production. Confirmation was done by noting the potentiation of the activity of cefoperazone in the presence of cefoperazone+sulbactum. An increase in diameter of 5 mm was considered positive for ESBL detection.

Detection of inducible and derepressed AmpC beta lactamase

Isolates resistant to ceftriaxone, cefixime, cefoperazone and cefoperazone sulbactam, and cefoxitin were tested for AmpC production. Organism resistant to cefoxitin, cefoperazone and cefoperazone combination were considered to be AmpC producers (Rizvi *et al.*, 2009).

Detection of Metallo-beta-lactamases

If the zone of imipenem was reduced to 16-20 mm or less or heaping occurred, we tested the isolate for MBL production. Hodge test and Double Disc synergy test using EDTA were used for detection of MBL. The method was as described by Lee et al. (2001).

Result and Discussion

Total 1386 surgeries were done over one year study period. Of these, 1108(79.9%) were abdominal surgeries. Drains were put in 886(63.9%) cases. 539 (60.8%) patients developing sign and symptoms suggestive of drain related infections (fever, redness, swelling around drain site, pus or discharge around drain opening) and drain samples were collected from these cases. Of these, 315(58.4%) showed bacterial growth while 13(2.4%) showed growth of Candida species. Amikacin ceftriaxone, and metronidazole were most commonly used antimicrobial agents during preoperative and postoperative periods.

To the best of our knowledge few studies have dealt the rate of colonization or infection in surgeries where drains are used. However, Paul et al. (1972) reported presence of bacterial growths when cultures from interior portion of the drains were taken. In 17 out of 50 of these patients, there were definite skin contaminants on the interior part of their drains. Another study by Manabu Kawai et al. (2006) showed (30.8%) infection rates when drains were left for more than 8 days however rates were lower when (3.7%) when period was reduced to 4 days. In our study average time duration for which the drain was put was 5±2 days.

In our study, Gram negative bacilli 234(74.3%) were the predominant bacterial isolates and among these the most common bacteria isolated were *Escherichia coli* 121(51.7%) followed by *Citrobacter species* 66(28.2%), *Pseudomonas species* 17(7.3%), *Klebsiella species* 16(6.8%), *Proteus species* 8(3.4%), *Acinetobacter species* 5(2.1%) and *Serratia species* 1 (0.4%). Amongst gram positive isolates, *Enterococcus species* 34(41.9%) *followed by Staphylococcus aureus 31(38.3%), Corynebacterium species* 13(16.0%) and *Coagulase negative Staphylococcus species* 3(3.7%) (Figure 1).

To our knowledge, no reports in the literature have evaluated the etiology and sensitivity profile of drain related intraabdominal infections. However, study by Manabu Kawai et al. (2006) has shown that most of the drain related infection occurred due to normal commensals of the skin. We also observed 16(2.9%) infection due to skin commensals. *E. coli* and *Enterococcus faecalis* were the common etiologies in our study. One reason behind this could be because these are the commensals in intestines and in our study most drain related surgeries had intestinal interventions.

Among the Enterobacteriaceae, susceptibility profile of *E. coli* to aminoglycosides, fluoroquinolones, cephalosporins, and cephalosporin-β-lactamase inhibitor combination was 34.7%, 74.3%, 4.9% and 19% respectively while that of *Citrobacter species* was 18.2%, 7.6%, 19.7% and 22.7% respectively. *Pseudomonas aeruginosa* demonstrated 58.8%, 41.2%, 35.3%, 41.2% and 52.9% sensitivity against aminoglycosides, fluoroquinolones, cephalosporins, penicillin, penicillin-β-lactamase inhibitor combination respectively (Table 1). *Staphylococcus aureus* was most susceptible to vancomycin (100%) followed by amikacin (74.2%), and gentamicin (58.1%).

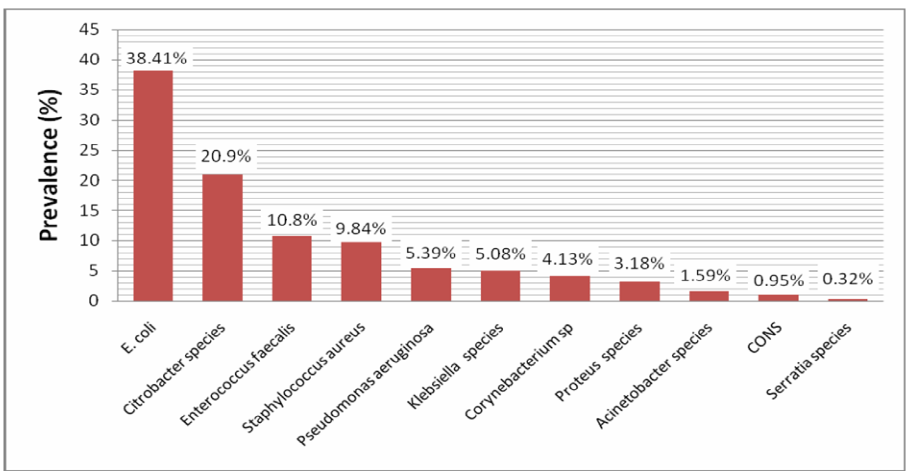
Table.1 Antimicrobial sensitivity pattern of Gram negative bacterial isolates

Antibiotics	***E. coli* n=121**	***Citrobacter sp* n=66**	***Klebsiella sp* n=16**	***Proteus sp* n=8**	***Acinetobacter sp* n=5**	***Serratia sp* n=1**	***Pseudomonas sp* n=17**
Amikacin	59(48.8)	19(28.7)	10(62.5)	1(12.5)	1(20)	0(0)	10(58.8)
Gentamicin	24(19.8)	5(7.6)	6(37.5)	0(0)	2(40)	0(0)	-
Tobramycin	-	-	-	-	-	-	10(58.8)
Cefepime	13(10.7)	14(21.2)	1(6.3)	0(0)	2(40)	0(0)	7(41.2)
Cefixime	2(1.7)	3(4.5)	1(6.3)	0(0)	1(20)	0(0)	-
Ceftriaxone	4(3.3)	3(4.5)	0(0)	0(0)	0(0)	0(0)	-
Cefoperazone	6(4.9)	6(9.1)	0(0)	0(0)	0(0)	0(0)	-
Cefoperazone+sulbactam	23(19)	15(22.7)	2(12.5)	1(12.5)	1(20)	0(0)	-
Ofloxacin	90(74.3)	5(7.6)	2(12.5)	6(75)	2(40)	0(0)	-
Ceftazidime	-	-	-	-	-	-	5(29.4)
Piperacillin	-	-	-	-	-	-	7(41.2)
Piperacillin+tazobactam	-	-	-	-	-	-	9(52.9)
Imipenem				-	-	-	-
Sparfloxacin	-	-	-	-	-	-	6(35.3)
Levofloxacin	-	-	-	-	-	-	8(47.1)
Cefixime+clavulanic acid		-	-	-	-	-	-

Table.2 Antimicrobial sensitivity pattern of Gram positive bacterial isolates

Organisms	S. aureus	CONS	Enterococcus species	Corynebacterium sp
Amoxicillin	-	-	9(26.5)	-
Ofloxacin	13(41.9)	0(0)	-	1(7.7)
Azithromycin	-	-	-	-
Erythromycin	15(48.4)	0(0)	6(17.6)	1(7.7)
Amikacin	23(74.2)	0(0)	-	0(0)
Gentamicin	18(58.1)	0(0)	-	1(7.7)
High content gentamicin	-	-	34(100)	-
High content Streptomycin	-	-	34(100)	-
Cefaclor	14(45.2)	0(0)	-	0(0)
Cefazolin	17(54.8)	1(25)	3(8.8)	1(7.7)
Oxacillin	16(51.6)	1(25)	-	0(0)
Vancomycin	31(100)	4(100)	34(100)	13(100)

Figure.1 Prevalence of bacteria isolated from surgical drains



Among Enterobacteriaceae, 29(13.8%) were ESBL produces and 171(81.4%) were AmpC producers. Singh et al (2012) had reported 27% ESBL production among the nosocomial isolates, however, in their study only 18% isolates were AmpC producers (Yalcin *et al.*, 1995). On the basis of our findings we conclude that gram negative etiology with MDR pathogens is common in contaminated wounds.

No MBLs were detected with all isolates being sensitive to imipenem. Patzer et al. (2008) had reported imipenem resistance in 2.4% isolates (Wilson *et al.*, 1986).

Among the gram positive isolates 48.4% strains of *S.aureus* were methicillin resistant which was quite high as compared to 14% incidence of MRSA in another study (Suchitra *et al.*, 2009). In our study amikacin and vancomycin were better therapeutic options for *S. aureus* infection.

No HLAR and VRE were detected in *Enterococcus species* while Suchitra et al. (2009) reported 1.4% incidence of VRE.

Controversy surrounds the indications for and effectiveness of the abdominal drain. There are a variety of factors which mitigate against formulating rigid guidelines for the indications of drains. Drains are not a substitute for meticulous surgical technique. However, when indicated, it is important that drainage should be practiced with prudence. Irrational use of antibiotics should be stopped. Drains should be removed as early as possible, atleast not beyond 5 days.

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