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Microbiological profile of abscesses of different body sites in a tertiary care hospital – the silent killer

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ABSTRACT

Background: Abscess, an infection with viable infecting organisms and polymorphonuclear cells, contained within a fibrous capsule, limiting the infection, and preventing its further spread. It may be monomicrobial or polymicrobial. **Aims and Objectives:** The aims of the study were to determine microbiological profile of abscesses of different body sites and associated complications. **Materials and Methods:** An observational study was conducted in our department with 35 pus samples from abscesses of different body sites between August 2022 and December 2022. Gram stain, Z-N stain, fungal stain, aerobic, anaerobic, and fungal culture were performed. Statistical analysis was done by statistical tool R. **Results:** Out of 35 samples-limb, liver,paraspinal, psoas, appendicular, breast, perineal, ear, brain and lung abscesses were 11,4,2,3,1,7,2,2,2,1 respectively. Most common organisms from limb,ear,paraspinal and breast abscesses was MRSA (Methicillin resistant *Staphylococcal aureus*). Also most common organisms were – *Escherichia coli* from liver abscess, *Enterobacteriaceae* and *Pseudomonas aeruginosa* from psoas and appendicular abscess, Enterobacter aerogenes from perineal, *Escherichia coli* and *Actinomyces* species from brain and *Candida auris* from lung abcesses. No growth were also found in few samples. Their susceptibility testing showed-MRSA strains susceptible to both Vancomycin and Linezolid, gram negative bacteria were susceptible to Cephalosporins, Piperacillin-tazobactam, Carbapenems, polymixins, etc. *C.auris* was resistant to all antifungals. Their blood samples were also collected - ten patients showed fever with bacteremia and one with candidemia . They were treated with systemic antimicrobials along with drainage and/or surgical resection. **Conclusion:** Abscesses must be suspected in cases with non-resolving fever with/without septicemia and treated promptly with appropriate antimicrobials based on susceptibility report and with drainage and/or surgical resection.

Key words: Abscess; Fever; Sepsis; Susceptibility testing

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INTRODUCTION

Abscess, an infection with viable infecting organisms and polymorphonuclear cells, contained within a fibrous capsule, limiting the infection, and preventing its further spread.[1] There is a central necrotic zone containing necrotic leucocytes and tissue cells, surrounding by a region of vascular dilation and fibroblastic and parenchymal proliferation which indicates chronic inflammation and repair.[2] It may be monomicrobial or polymicrobial.[3] An abscess may represent a host response or a diseased state.[1] Lung abscesses are formed following microbial infection as a result of necrosis and cavitation.[1] Intra-abdominal abscesses are common in case of untreated peritonitis.[1] A focal suppurative infection of brain parenchyma surrounded by a vascularized capsule is seen in case of a brain abscess.[1] An abscess inhibits the influx of immunoreactive cells and antibiotic effectiveness.[2] The management will depend on the location, size, clinical symptoms, underlying clinical conditions, and resulting complications.[3] Incision and drainage is the effective mode of treatment in most cases.[3] However, complex abscesses

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may require surgical intervention and debridement along with antibiotics.[3] If left untreated, the abscess increases in size until rupture, and also, there is non-resolution of patients symptoms such as fever and/or pain at local site of abscess.[1] Hence, this study was conducted in R.G. Kar Medical College with the following.

Aims and objectives

The objectives of the study are as follows:

1. To determine the microbiological profile of abscesses of different body sites
2. To assess the associated complications.

MATERIALS AND METHODS

An observational study was conducted in our department with 35 pus samples from abscesses of different body sites between August 2022 and December 2022. Gram stain, Z-N stain, fungal stain; aerobic, anaerobic, and fungal culture were performed. Fungal stain using 10% KOH was used to see fungal hyphae and yeast cells. For anaerobic culture, samples were collected in tubes with cork cap sealed with leucoplast or syringes with tip inserted into cork cap or samples in Robertson's cooked meat broth medium. Aerobic culture is done on blood agar and MacConkey agar and incubated for 18–24 h. For anaerobic culture, we had used blood agar which was streaked and incubated in a Mcintosh Fildes jar containing gas-pak sachet and thioglycolate broth was also used. Fungal culture was performed on Sabouraud dextrose agar with chloramphenicol. Mycobacterial culture was also performed in suspected cases using Lowenstein–Jensen media. In highly suspected cases, Truenat MTB assay was also done. Wet mount including saline mount was performed for looking for parasites especially motile trophozoites. The blood culture samples of these patients were also collected. Bacteriological and fungal susceptibility testing were done for both abscess pus samples and blood samples. Kirby–Bauer disk diffusion method was used for sensitivity testing. The patients were then treated with systemic antimicrobials, along with drainage and/or surgical resection.

Inclusion criteria

All patients with abscesses of different body sites within the study period were included in the study.

Exclusion criteria

Patient who did not give consent were excluded from the study.

Ethical clearance

The ethical approval of the study was taken from the Institutional Ethics Committee, R.G. Kar Medical College and Hospital, Kolkata.

Statistical analysis

The data obtained were analyzed with statistical tool R. The different percentages were calculated. Fisher's exact test/one-way Chi-square test was used for comparative analysis. The tests were evaluated at a confidence level of 95% and $P<0.05$ was considered significant.

RESULTS

During the study period of August 01, 2022–December 01, 2022, samples were collected from randomly selected 35 patients, fulfilling selection criteria. Patients with age group range 0–100 years including 60% male and 40% female patients.

Figure 1 shows percentages of age distributions among patients with abscess of different body sites.

Table 1 shows percentages of predominant risk factors in different types of abscesses. In the table, all the risk factors are significantly associated with different abscesses ($P<0.05$).

Table 2 shows microbiological profile of abscesses of different body sites.

Table 3 shows complications associated with different types of abscesses.

DISCUSSION

The present study was conducted in the Department of Microbiology, R.G. Kar Medical College and Hospital, Kolkata with objectives of determining microbiological profile of abscesses of different body sites and assesses the associated complications. The key findings of our study

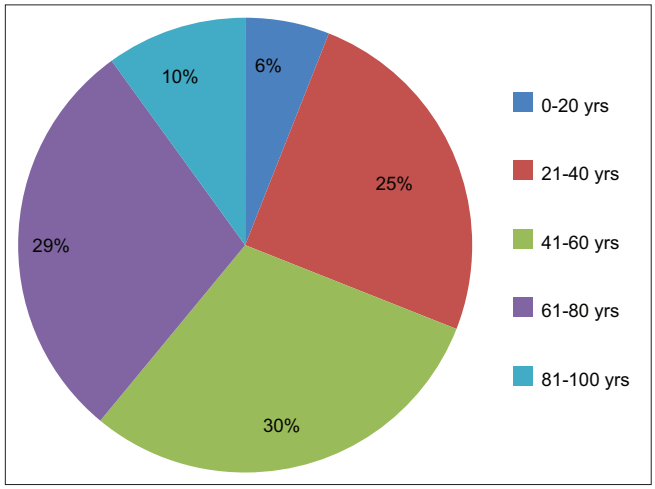

Figure 1: Age group distribution among patients with abscess of different body sites

were as follows – out of total 35 patients with different types of abscesses, 60% were male and 40% were female patients. Age distribution was of range 0–100 years and maximum number of patients belonging to 41–60 years age group. They had several risk factors which might have predisposed them to develop abscesses at different body sites like diabetes mellitus associated with some of the patients with limb abscess, ear, and perineal abscesses; diabetes mellitus with lactating mothers developing breast abscess; and peritonitis, osteomyelitis of vertebral bone, appendicitis, sinusitis-mastoiditis, immunosuppression with corticosteroids in liver, psoas, appendicular, brain, and lung abscesses, respectively. Most common organism isolated from limb, ear, paraspinal, and breast abscesses was methicillin-resistant *Staphylococcus aureus* (MRSA) and *Escherichia coli* from liver abscess. Different members of *Enterobacteriaceae* and *Pseudomonas aeruginosa* were isolated from psoas abscesses and appendicular abscesses, *Enterobacter aerogenes* and *Klebsiella pneumoniae* were isolated from perineal abscesses. *E. coli* and *Actinomyces* species from brain abscesses and *Candida auris* from lung abscesses. Their susceptibility testing showed MRSA strains susceptible to vancomycin and linezolid, while most Gram-negative bacteria were susceptible to third-generation cephalosporins, piperacillin-tazobactam, carbapenems, and polymixins. *C. auris* was found to be resistant to azoles and amphotericinB. The blood samples collected showed bacteremia in ten patients and one with candidemia.

Table 1: Most common risk factors associated with abscesses of different body sites

Type of abscess	Most common risk factor with %
Limb abscess	Diabetes mellitus (63.6)
Liver abscess	Peritonitis with chronic liver disease (75)
Paraspinal abscess	Nothing found
Psoas abscess	Osteomyelitis (33.3)
Appendicular abscess	Appendicitis (100)
Breast abscess	Diabetes mellitus and lactating mothers (57)
Perineal abscess	Diabetes mellitus (50)
Ear abscess	Diabetes mellitus (50)
Brain abscess	Sinusitis with mastoiditis (50)
Lung abscess	Immunosuppression with corticosteroids (100)

In our study, there are 60% male and 40% female patients and most common age group affected was affected was 41-60 years. As per several studies, middle aged men are more commonly affected than middle aged women.[1] So, our study corroborates with other studies.

In the present study, different risk factors were associated with different types of abscesses of different body sites such

Table 2: Microbiological profile of abscesses of different body sites

Site of abscess	Number	Micro-organisms	Sensitive antibiotics
Limb abscess	11	MRSA (8)	VA (30).LZ (30)*
		MSCONS (2)	NAF (1), OXA (1)
		Klebsiella pneumoniae (1a)	CTR (30), CTX (30), MRP (10), IMP (10), PIT (100/10), COT (25)
		Enterococcus spp. (1b)	VA (30), LZ (30)
Liver abscess	4	*Escherichia coli* (2), *Klebsiella pneumoniae* (1)	CTR, CTX, MRP, IMP (for both)
		MRSA (1)	VA, LZ
Paraspinal abscess	2	MRSA (1)	VA, LZ
		No growth (1)	--
Psoas abscess	3	*Proteus mirabilis* and *Escherichia coli* (1)	CTR, CTX, MRP, IMP
		Pseudomonas aeruginosa and *Klebsiella pneumoniae* (1)	CAZ (30), PB (300units), MRP
		No growth (1)	--
Appendicular abscess	1	*Klebsiella pneumoniae* and *Pseudomonas aeruginosa* (1)	CAZ, PB, MRP, IMP, PIT
Breast abscess	7	MRSA (6)	VA, LZ
		MSSA (1)	NAF, OXA
Perianal abscess	2	*Enterobacter aerogenes* (1)	CTR, MRP, IMP, PIT
		Klebsiella pneumoniae (1)	CTR, CTX, MRP, IMP
Ear abscess	2	MRSA (1)	VA, LZ
		No growth	--
Brain abscess	2	*Escherichia coli* (1)	CTR, MRP, IMP, CPM (30)
		Actinomyces species (1)	Testing not performed
Lung abscess	1	*Candida auris* (1)	Resistant to VRC (1), ITRA (10), FLU (25), AMB (20). Testing not done for Echinocandins
Total	35		

VA: Vancomycin, LZ: Linezolid, NAF: Nafcillin, OXA: Oxacillin, CTR: Ceftriaxone, CTX: Cefotaxime, CAZ: Ceftazidime, MRP: Meropenem, IMP: Imipenem, PB: Polymixin B, PIT: Piperacillin/Tazobactam, CPM: Cefepime, VRC: Voriconazole, ITRA: Itraconazole, FLC: Fluconazole, AMB: Amphotericin B. MRSA: Methicillin-resistant *Staphylococcus aureus*, MSCONS: Mthicillin sensitive Coagulase negative *Staphylococcus*, MSSA: Methicillin sensitive *Staphylococcus aureus*. 1a and 1b are the two different organisms isolated from same sample. *All drug disc concentrations are in microgram, only polymyxin B is in units

Table 3: Complications associated with different types of abscesses

Site of abscess	Most common complications	Number of cases
Limb abscess	Sepsis	5
Liver abscess	Sepsis	3
Paraspinal abscess	Pain at local site	2
Psoas abscess	Sepsis	1
Appendicular abscess	Sepsis	1
Breast abscess	Fever	5
Perineal abscess	Pain at local site x+fever	2
Ear abscess	Earache	2
Brain abscess	Headache+fever	2
Lung abscess	Candidemia	1

as – diabetes mellitus in limb abscess (63.6%), ear abscess (50%), and perineal abscesses (50%) cases; lactating mothers with diabetes mellitus were a risk factor in developing breast abscess in 57% cases; peritonitis with chronic liver disease, osteomyelitis of vertebral bone, appendicitis, sinusitis-mastoiditis, and immunosuppression with corticosteroids as risk factor was found in liver abscess – 75%, psoas abscess – 33.3%, appendicular abscesses – 100%,brain abscess – 50%, and lung abscesses –100%, respectively. However, the paraspinal abscesses did not have any associated risk factors. Several data suggest that these are the common risk factors of different types of respective abscesses associated with one-third (33.3%) to half (50%) of all such cases having abscesses.[1] Hence, there is somewhat discrepancy with the above data obtained from our study which can be due to difference in demographic patterns.

In our study, most common organism isolated from limb abscesses was MRSA-73%. Another study by Radhi et al., shows that 75% of limb abscesses cases were caused by *Staphylococcus aureus*.[4] Hence, our study results corroborate with the above study. In our study, liver abscess growing *E. coli* was found in 50% cases. In another study by Serraino et al., the percentages of patients with *E. coli* in pyogenic liver abscess was 26.5%.[5] Hence, there is some discrepancy which may be due to difference in geographical distributions. In our study, the paraspinal abscesses had grown MRSA in one abscess pus sample. Furthermore, in another study by Radhi et al., showed, *S. aureus* commonly isolated in most of the abscess samples.[4] Another paraspinal abscess in our study which was a suspected cold abscess did not show any growth in either pyogenic or mycobacterial cultures and nothing suggestive of acid-fast bacilli in Z-N staining; also, it was Truenat MTB assay negative. Another study by Sabr et al., showed that cold abscesses are rare and unusual for tuberculosis accounting for 1% of extrapulmonary tuberculosis.[6] Hence, our study corroborates with above study. In our study, most common organism isolated from psoas abscess was belonging from *Enterobacteriaceae* family -67%. In another study by Tomich et al., the most common organism isolated from psoas abscess was *S. aureus* followed by *Enterobacteriaceae* and anaerobes.[7] Hence, our study does not corroborate with above study which may be due to difference in geographical distribution and demographic patterns. In our study, we got *K. pneumoniae* and *P. aeruginosa* from appendicular abscess pus. In another study by Jones et al., common organisms obtained were *E. coli, Peptostreptococcus*, *Bacteroides,* and *Pseudomonas* species.[8] Hence, our study corroborates with above study. In our study, breast abscess grew *S. aureus* in all abscess pus samples including 6 MRSA and 1 MSSA. In another study by Alvarez et al., most commonly organisms isolated from breast abscess was *S. aureus*.[9] Hence, our study corroborates with the above study. In our study, we got *E. aerogenes* (50%) and *K. pneumoniae* (50%) from perineal abscess pus samples. In another study, by Liu et al., most common isolates obtained were *K. pneumoniae* (60%).[10] Hence, our study results almost corroborate with above study. In our study, *S. aureus* was isolated from 50% of ear abscess samples. In another study by Getaneh et al., *S. aureus* was most common organism isolated (27.9%).[11] These discrepancies in results may be due the smaller sample size in our study. In our study, we isolated *E. coli* (50%) and *Actinomyces* species (50%) from two separate brain abscess pus samples. However, data from different studies show, most common cause of brain abscess is *Streptococcus* species (40%), anaerobes (30%), and *Enterobacteriaceae* family (25%).[1] Hence, our study result do not corroborate with above data which may be due to difference in geographical distribution and smaller sample size in our study. In our study, we had got *C. auris* in lung abscess pus sample from an intensive care unit (ICU) patient who was taking corticosteroids. In another study by Abdelhadi et al., the development of *Candida* lung abscess is extremely rare and may be seen in severely immunocompromised patients admitted in the ICU.[12] Hence, our study results corroborate with above study.

In our study, most commonly sensitive antibiotics in Gram-positive organisms were vancomycin and linezolid and Gram-negative organisms were third-generation cephalosporins (100%), carpenems (100%), piperacillin-tazobactam, and polymyxin B. In another study by *Trojan* et al., *S. aureus* was highly susceptible to vancomycin (100%) and linezolid (100%) and Gram-negative organisms susceptible to imipenem (89%) and meropenem (84%) and also sensitive to cephalosporins and polymyxin B.[13] Hence, our study shows somewhat discrepancies which may be due to difference in antibiogram patterns. In our study, *C. auris* isolated from lung abscess was found to be resistant to fluconazole, voriconazole, itraconazole, and amphotericin B and sensitivity testing for echinocandins could not be performed due to lack of facility in our institution. As per centers for disease control guidelines, in United States 90%, *C. auris* was resistant to fluconazole, 30% resistant to amphotericin B, and <5% to echinocandins.[14] Hence, our study corroborates with above data.

In our study, most common associated complications were sepsis (31.4%) followed by fever (25.7%). In another study by *Brito* et al., most common complication of abscess were septic shock (16.8%).[15] Hence, there is somewhat discrepancies which may be due to smaller sample size in our study.

Limitations of our study

Strength of our study was that it was an extensive study. We studied the gender prevalence, age group distribution, risk factors, microbiological profile, and different complications associated with abscesses. Furthermore, the importance of suspicion for underlying abscess in a patient suffering from non-resolving fever or sepsis was enlightened. Although the study was extensive, there were some limitations such as (1) shorter duration of study and smaller sample size, (2) susceptibility testing for echinocandin could not be done for *C. auris* isolate due to lack of facility, and (3) susceptibility testing could not be performed for *Actinomyces* species due to lack of facility.

CONCLUSION

We can conclude that abscesses must be suspected in cases with non-resolving fever with/without sepsis and treated promptly with appropriate antimicrobials based on susceptibility report and with drainage and/or surgical resection. Furthermore, as we have seen MRSA and members of *Enterobacteriaceae* family are responsible for most of the abscesses, so this information can help in choosing the empirical antimicrobial therapy when abscess pus culture and sensitivity reports are awaited.

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Authors' Contributions:
SG- Definition of intellectual content, literature survey, prepared first draft of manuscript, implement of study protocol, data collection, data analysis, manuscript preparation, submission of article, concept, design of study, statistical analysis and interpretation; **RRG-** Editing and manuscript revision; **MB-** Editing and manuscript revision

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