Original Article

A Study of Patients with Community Acquired Abscesses at Khartoum North Teaching Hospital

Gamal E H A El Shallaly*, Abdullahi N Hassan , Noha O Siddig, Razaz A Mohammed, Emtinan A Osman, Myada A Ibrahim.

Abstract

Background: Abscess incision and drainage (I&D) operation represents the bulk of surgical procedures in the emergency department (ED). Nevertheless, epidemiological, clinical, and bacteriology data are lacking or non-existent on patients with abscesses. Information is also lacking on the magnitude of the problem of community acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA), and their susceptibility to the most commonly used antibiotics.

Objectives: To identify and document epidemiological and clinical variables of patients with superficial abscesses, and isolate the causative organism(s) in the pus and determine their antibiotic susceptibility. Also, to determine the prevalence of CA-MRSA and their antibiotic susceptibility and ao audit our practice of I&D of abscess.

Patients and Methods: A prospective observational study, involving a convenience sample of patients who presented with community acquired skin and soft tissue (superficial) abscesses to a single unit at Khartoum North Teaching Hospital (KNTH) emergency department (ED), was done during the period 2009-2010. A pro-forma was designed to record the personal, epidemiological, and clinical data of each patient. The I&D of the abscesses was performed as a day case. Swabs of pus drained from the abscess were sent to the laboratory for culture. Micro-organisms isolates underwent susceptibility testing against a group of the most commonly used antibiotics.

Results: A total of 248 patients were included in the study. The majority (84%) were below the age of 40 years. Males (69%) were twice as many as females (31%). The majority of patients did not have a known predisposing factor, but 13% had a previous history of an abscess. A history of trauma was found in 27% of the patients, whereas diabetes mellitus history was obtained in only 6%. The most common site of the abscess was the upper limb (46%) followed by the lower limb (20%). The study showed that 85% of the abscesses were drained under local anaesthesia.

Susceptibility tests were performed on 151 pus specimens using a group of commonly used antibiotics. 123 (81.5%) specimens grew micro-organisms. Of those, *Staphylococcus aureus* was the commonest organism grown (90%), followed by *Klebsiella spp* (6.5%). The proportion of CA-MRSA was 24%. High proportions of *S. aureus* were resistant to other antibiotics too. Lists of antibiotics and their efficacy in the treatment of *S. aureus* and *Klebsiella* were constructed.

Conclusion: This study documents some epidemiological and bacteriological data on one of the most common surgical problems. The study showed the presence of a significant proportion of CA-MRSA. This reflects the abuse of antibiotics in the community and stresses the importance of health education. Standardized surgical and anaesthetic guidelines on I&D of abscess should be followed to avoid recurrences. Further studies are urgently needed.

Key words: Antibiotics, Community Acquired Methicillin Resistant Staphylococcus aureus (CA-MRSA), surgical drainage.

INCISION and drainage (I & D) of abscesses constitutes the bulk of surgical emergency operations during any on-call duty. At Khartoum North Teaching Hospital (KNTH) emergency department (ED), 20-30 such operations are performed each day. Nevertheless, epidemiological, clinical and bacteriological information on both patients and causative micro-organisms are lacking or non-existent. Recently the problem of Methicillin-Resistant *Staphylococcus aureus*

*Correspondence: Prof Gamal E H A El Shallaly Email:gamalshallaly@rcsed.ac.uk.

(MRSA), particularly those acquired in the community (CA-MRSA) has become a major health issue as a cause of skin and soft tissue infections (SSTIs) particularly abscesses. Unfortunately, knowledge of their proportion in the abscesses drained and their antibiotic susceptibility is completely lacking in Sudan.
In this era of evidence based medicine, obtaining such information is vital in order to make guidelines for prevention and treatment of this common surgical problem. This study aims to reduce this gap in our knowledge. In addition, we aim to audit our practice of abscess drainage.

Patients and Methods
We conducted a prospective observational descriptive study, involving a convenience sample of patients who presented to KNTH ED with community acquired superficial (cutaneous and subcutaneous) abscesses (CA-A). We included patients presenting on our unit's on-call day, which occurs every 6th day of the week. Inpatients, with hospital-acquired abscesses (HA-A), were excluded. A pro-forma was used to collect personal, clinical, operative and postoperative data of these patients**.**
The operations were done in a dedicated theatre for septic cases. The incision and drainage of abscesses were done according to a standardized procedure under different anaesthetic techniques as thought appropriate. These included general, local and regional anaesthesia. A sample of the pus drained was collected under strict aseptic techniques using a special bacteriological swab provided by our central laboratory. This pus sample was sent immediately at the end of the operation list back to the lab, where culture of the micro-organisms was done. In those specimens that grew a specific micro-organism, sensitivity (susceptibility) tests against more than 20 of the commonly used antibiotics were undertaken.
Laboratory techniques (culture and susceptibility tests)
All of the swabs were cultured on several different media. These included: 2 blood agar media (one under aerobic and the other under anaerobic conditions), chocolate blood agar, MacConkey agar (Oxoid-UK), and cooked meat media. The media were incubated for 48 hours. Presence of significant growth was further studied to identify microorganism by using appropriate biochemical tests and serology.
Susceptibility tests to a group of about 20 of the most commonly used antibiotics were done using HiMedia discs, (Mumbai, India). For Gram-negative bacteria we used the following antibiotics: ciprofloxacin, amoxicillin/clavulanic acid, ceftriaxone, cefuroxime, co-trimoxazole and chloramphenicol. For Gram-positive bacteria, we used: amoxicillin/clavulanic acid, tetracycline, ceftriaxone, co-trimoxazole, oxacillin and Vancomycin. Antibiotic sensitivity tests were performed using Kirby-Bauer disk diffusion method. Results were interpreted according to the guidelines of Clinical and Laboratory Standards Institute CLSI (formerly NCCLS) [1].
Antibiotic susceptibility of each organism was classified into 3 categories: sensitive, intermediate sensitivity, and resistant. This was done according to the zone size interpretative chart, which are based on results obtained using Mueller Hinton Agar (HiMedia Laboratories Pvt. Limited, Mumbai, India)
Data were summarized and grouped into a master sheet, computed and analyzed with statistical package of social sciences (SPSS) software program. Frequencies and proportions of common microorganisms causing community acquired abscess, type of abscess and their antibiotic sensitivity were calculated.
Results: A total of 248 patients were included in the study. There were 171 (69%) males. Two thirds of the patients (66.4%) were between the ages of 11-30 years, and (84.1%) were below 40 years (Figure1). Almost half (46%) of the patients were manual workers (Table1). Students accounted for 17%, followed by office employee and housewives; 11% each. Children accounted for 10%, and 5% were a group of unemployed adults patients

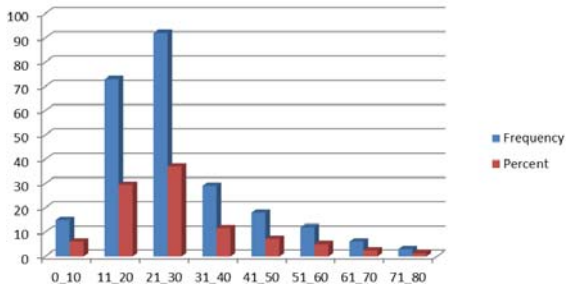


Figure1: Age distribution of patients with abscesses (n=248).

Table1. Classification of abscess patients according to Occupation (n=248)

Occupation	Number	%
Manual Workers	114	46%
Students	43	17%
Office Employee	27	11%
Housewives	27	11%
Children	25	10%
Unemployed	12	5%
Total	248	100%

The history data showed expectedly that pain was the most common presenting symptom. Interestingly, 21% of the patients admitted having a pre-hospital treatment of some sort. This included antibiotics, herbs, or hot soaks (Table2).

Table2. History of symptoms (n=248)

	Number	%
Pain is the main symptom	233	94%
Thickness and tenderness at site of pain	102	41%
Mass	99	40%
Discharge	107	43%
Fever	78	31.5%
Pre-hospital treatment with antibiotics	4	1.5%
Pre-hospital treatment with warm soaks	26	10.5%
Pre-hospital treatment with herbs	22	9%

*Some patients presents with more than one symptom

There was a previous history of an abscess in 32 (13%) patients. Of those, 20 (63.5%) patients had an abscess recurrence in the same site, commonly in the peri-anal area. History of trauma was obtained in 27% of the patients, diabetes mellitus in 6%, and drug addiction was volunteered by only one patient. We obtained no history of intramuscular injection as a predisposing factor in this study. In the rest of the patients no cause was specified (Table3).

Table3. Predisposing factors (n=248)

	Number	%
Trauma	67	27%
Diabetes mellitus	15	6%
Previous history of abscesses	32	13%
Drug addiction	1	0.4%
Intramuscular injection	0	0
No predisposing cause	133	53.6%
Total	248	100

Clinically, the anatomical sites of the abscess revealed that most of the abscesses occurred in the upper limbs (46%), followed by the lower limbs (20%) (Table4).
The diagnosis was done mainly on clinical grounds. Confirmatory aspiration of the pus was done in 4.5% of the patients. In our practice no patient was sent for ultrasound or CT scan.
Most of the abscesses were drained under local anaesthesia (85%), and all the patients were discharged home in the same day.

Table4. Anatomical site of the abscess (n=248)

	Number	%
Upper limb	115	46.4%
Lower limb	50	20%
Head and neck	41	16.5%
Trunk	17	7%
(Breast)	(4)	1.6%
(Gluteal)	(11)	4.4%
Perineum	25	10%
Total	248	100%

Bacteriology (culture and sensitivity) tests were done on pus specimens obtained from 151 patients. 123 specimens (81.5%) grew micro-organisms. *Staphylococcus aureus* was

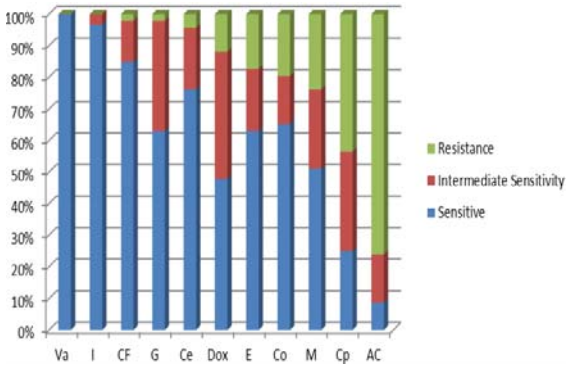
isolated in 111 (90.25%) of these cultures (Table5).

Table5. Results of culture and susceptibility tests of abscesses in 123 patients

Micro-Organism	Number	%
Staph. *aureus*	111	90.25%
Kleb. pneumonia	8	6.50%
Pseudo.*auregunosa*	2	1.63%
Proteus *vulgaris*	1	0.81%
Strept. *pyogenes*	1	0.81%
Total	123	100%

Staphylococcus isolates were subjected to susceptibility tests against a group of the most commonly used antibiotics using standardized bacteriology techniques. Accordingly, the organisms were categorized into 3 groups: those that showed sensitivity, intermediate sensitivity, or were resistant to the particular antibiotic (Figure2).

Figure2. Results of 111 Staph. *aureus* Antibiotic Susceptibility Tests.

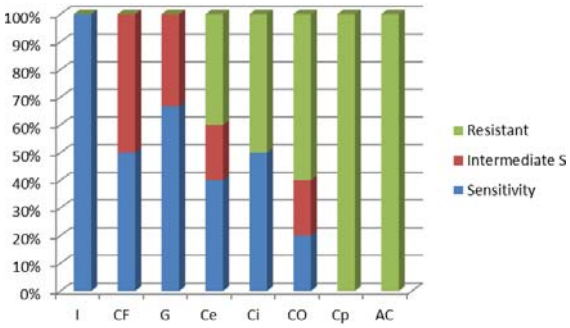


Va= Vancomycin. I=Imipenem. CF= Ciprofloxacin. G= Gentamicin. Ce= Cefotaxime. Dox= Doxycycline. E=Erythromycin. C0=Cotrimoxazole. M=Methicillin. Cp= Cephalexin. AC=Amoxiclavulanic acid.
NB. CA-MRSA=24%

There were a total of 20 (24%) community-acquired *Staphylococcus aureus* (CA-MRSA) that showed resistance to the commonly used and advocated antibiotic cloxacillin and Methicillin.

Six (75%) of the 8 Klebsiella organisms were isolated from abscesses in the perineum and lower limbs. Susceptibilty tests were also done and categorized as above (Figure3).

Figure3. Results of 8 Klebsiella spp Antibiotic Susceptibility Tests



I=Imipenem. CF= Ciprofloxacin. G= Gentamicin. Ce= Cefotaxime. Ci= Ceftriaxone. C0=Cotrimoxazole. Cp= Cephalexin. AC=Amoxiclavulanic acid.

Discussion

The observation that so many patients with superficial abscesses acquired in the community kept, and still keeping, presenting at the surgical casualty was the trigger of this study. The work-load of the operation of 'incision and drainage of an abscess' at KNTH casualty has been estimated between 20-30 operations/day, constituting about 70-80% of all surgical operations performed on one on-call day.

Since there are no definition in the literature, we propose to define community acquired abscess (CA-A) as an abscess acquired in the community where the patient had not been in hospital for at least 4 weeks before acquiring the abscess.

Our unit covers casualty every 6th day of the week. Patients with superficial abscesses who attended the casualty during our on-call were included in the study.

It was striking, though not surprising, that the majority of patients (84%) were aged below 40 years of age. This is similar to the findings of Mahdi et al at Khartoum Teaching Hospital[2]. Two thirds of the patients were within the active age group 11-30 years, and

there is a peak of cases in the 21-30 years group (Figure2). This reflects the fact that abscesses inflict the young and economically active age group.

Manual workers constituted almost half of the patients (46%). This could explain the finding that most abscesses occurred in the upper limbs (46%). Those manual workers and employed office workers constituted together 57% of the patients. This reflects the huge economic impact of the abscess problem on the individual patient and on the community in the way of lost working hours. The unemployed constituted only 5% of the patients, whereas housewives and children constituted together 21%. Health education particularly regarding washing hands with soap and water after work, play, and household activity may help reduce hand contamination and hence decrease the likelihood of acquiring an abscess.

The majority of abscesses (54%) occurred in previously healthy patients were without a known predisposing factor. This was also observed by Gorak et al from the USA[3]. Diabetics constituted only 6% of our patients. This may be due to the fact that 84% of our patients are young (below 40years).

In contradistinction with the findings of Frazee et al, injection of illicit drugs was admitted by only one patient[4]. A history of some sort of trauma was found in 27% of the patients, whereas none had a history of intramuscular injection of drugs such as chloroquine, which we used to see in the past. This may be due to the fact that chloroquine is no longer used for treatment of malaria in Khartoum state due to the emergence of resistant plasmodia strains.

Although the majority of patients didn't have a history of a known predisposing factor, there was a past history of abscess in 13% of the patients. These occurred mostly in the same site (63.5%), especially peri-anal abscesses. Further studies are required to explore the cause(s) of this observation. However, finding that 85% of the abscesses were drained using local anaesthesia, may partially explain the high recurrence rate as due to inadequate drainage.

Clinically, about two thirds of the abscesses were in the limbs: 46% in the upper and 20% in the lower limbs. This is different from the study at Khartoum where head and neck had the highest percentage[2]. Auditing our practice revealed that the diagnosis was made mainly on clinical grounds. Confirmatory aspiration of pus was done in only 4.5% of patients. No patient was sent for ultrasound or CT scans. We also found out that 85% of the abscesses were operated under local anaesthesia. This may be due to lack of resources or simply a 'surgical culture' in the Sudanese practice. It must be pointed out that local anaesthesia does not work in acidic medium. Hence, the analgesic effect may not be enough and the pain prevents adequate drainage. In addition there are concerns that infection may be helped to spread into different planes by the needle. We may, therefore, propose that the high proportion of recurrences we found in this study may be due to the use of local anaesthesia in our emergency departments, not only at KNTH, but also in most hospitals in Sudan. Guidelines must be clearly set to recommend incision and drainage of abscesses under adequate analgesia, and this certainly should not be given locally. Since most abscesses are in the limbs, techniques such as Bier's block and digital blocks, spinal anaesthesia may be considered, if general anaesthesia is not available.

Bacteriology (culture and susceptibility) tests on pus specimens showed that *Staphylococcus aureus* was the causative organism in the majority (90%) of cases in which micro-organisms could be grown. This was conforming to most previous studies[2-4]. Our study showed, for the first time in Sudan, that community-acquired methicillin-resistant *Staph. aureus* (CA-MRSA) constituted almost a quarter (24%) of the organisms isolated. Although some studies from abroad revealed a higher incidence of CA-MRSA amounting in one study to 51% in the emergency department (4), our data are still alarming, and may reflect the abuse of antibiotics by both doctors and patients in the community. These data, which are revealed for the first time in Sudan, should call for setting up

guidelines for the appropriate use of antibiotics in general within the community. CA-MRSA is known to infect young otherwise healthy individuals[5, 6]. The increasing numbers of patients presenting with abscesses, an observation not only seen at KNTH, but also at all the major hospitals in the capital Khartoum may be due to the high proportion of CA-MRSA. It may also explain the fact that in over half of our patients there was no predisposing factor, such as diabetes or other cause of immune-compromise.

Antibiotic susceptibility tests of Staphylococcus showed high sensitivity to vancomycin (100%), imipenem (97%), ciprofloxacin (85%), and cefotaxime (76.5%). It is to be noted that a drug, such as gentamicin has shown a lower sensitivity percentage (63%) than cefotaxime. However, it has a lower resistance rate (2%) than cefotaxime (4%). Hence we propose the use of s*ensitivity: resistance ratio* (SSR) as a mathematical tool to compare the efficiency of different drugs. This ratio is calculated by dividing the sensitivity percentage by the resistance percentage of the micro-organism under question to each drug. We believe that the ratio can give a better description than pure percentages, and allows the prescribing doctor to compare the efficiency of different antibiotics and chose the most appropriate one against a certain micro-organism. In the comparison mentioned above: gentamicin has a higher SRR of (32:1) than cefotaxime (19:1).

On the other hand, Cephotaxime (SRR=19:1), was shown to be more efficient than cephalexin (SRR=1:2). The latter shows 'reversal' of the ratio, meaning there are more resistant cases to this drug.

This study has also, interestingly, showed high resistance of *Staph. aureus* (and low SRR) to the following commonly used antibiotics: co-trimoxazole 20%, SRR 3:1), methicillin/cloxacillin 24%, SRR 2:1). There were 76% resistance cases to amoxiclavulinic acid, showing a 'reversed' SRR (1:8). These findings are significant, since these three drugs can no longer be recommended for prophylaxis and treatment against Staphylococcal infections in Sudan. This is stated, despite the fact that co-trimoxazole is used extensively in some other countries such as the USA to treat MRSA[7]. In our study, however, 65% of the Staphylococcus isolates were sensitive to Co-trimoxazole, whereas 20% were resistant (SRR=3.2:1). We would, generally speaking, not recommend an antibiotic with an SRR of less than five, since it would mean its inefficiency in one out of four patients, a too low probability to depend on.

Our study reveals, for the first time in Sudan, the magnitude of the problem of CA-MRSA. Our data showed a high resistance rate against Methicillin/Cloxacillin (24%), and SRR of 2:1. No studies were done in Sudanese hospital casualties before, despite the fact that I&D of abscess constitutes the majority of emergency surgical operations performed. It could, therefore, be proposed that the observed increase of abscesses presenting to casualty is due, at least in part, to the increasing prevalence of CA-MRSA.

This finding is alarming since these abscesses were acquired in the community and not in hospitals. If the proportion of CA-MRSA is that high; we would expect hospital-acquired (HA-MRSA) to be much higher. Further studies are thus needed to explore this problem in inpatients too.

The high CA-MRSA indicates an abuse of antibiotics in the community. This may occur at the level of patients, doctors and pharmacists. It is to be noted that this has become a worldwide problem. Health education and several approaches have been suggested to reduce antibiotic resistance in the community[8]. *Klebsiella spp* were isolated in eight of all the specimens of pus (5.3%). The pus was drained mainly (75%) from the peri-anal and lower limb abscesses. This is not surprising, since *Klebsiella* is one of the natural flora of the bowel, and can contaminate the peri-anal area. *Klebsiella* antibiotic susceptibility tests showed high sensitivity to imipenem, ciprofloxacin, tetracycline, gentamicin, and amikacin. It showed high resistance to the rest of antibiotics tested, notably the 3rd generation

cephalosporines cefotaxime (40%) with SRR of 1:1, and ceftriaxone (50%) with SRR of 1:1. *Klebsiella* also showed high resistance to Co-trimoxazole (60%) with a reversed SRR (0.33:1). It notably showed 100% resistance to Cephalexin, ceftazidime and Amox-clavulanic acid (SRR=0). Care must be taken in interpreting these results since the number of isolates is very small.

Other micro-organisms isolated included two cases of *Pseudomonas spp*, one case of Haemolytic *Streptococcus*, and another of *Proteus vulgaris*. Notably, *Pseudomonas spp* was isolated from head and neck abscesses. It was sensitive to imipenem, gentamicin, ciprofloxacin, and cefotaxime. *Streptococci* showed sensitivity to cefotaxime, vancomycin, tetracycline, and gentamicin, and intermediate sensitivity to amikacin, and resistance to co-trimoxazole. *Proteus vulgaris* was sensitive to imipenem, ciprofloxacin, ceftazidime, ceftriaxone, and co-trimoxazole. It was resistant to cefotaxime, and had intermediate sensitivity to amikacincefalexin, and amoxyclavulinic acid.

This, and similar studies, on antibiotic susceptibility of micro-organisms, are useful as they give the treating doctor information on micro-organisms antibiotic susceptibility in cases when the empirical use of antibiotics is important and/or urgent before the results of culture arrive.

These tests and susceptibility tables have to be updated from time to time and from place to place to cope with the micro-organisms changing antibiotic resistance.

It is to be stressed that the definitive treatment of a formed abscess is incision and drainage. Antibiotics should not be given to patients with formed abscess as it will not help as well as it can form an 'antibioma'. Antibiotics can be used during the early 'cellulitis' or inflammatory phase, to tip the balance in favor of body defenses and abort the formation of an abscess. This is particularly helpful in diabetics and immune-compromised patients. The use of antibiotics *after* incision and drainage of an abscess is controversial. Some randomized studies concluded it may reduce the incidence of recurrence or formation of another abscess[7].

We had to deal with certain difficulties during the conduction of this study. Sampling was interrupted several times due to the lack of financial support. This was needed mainly to cover the cost of culture and sensitivity tests. At the time the price of a single test was 15 Sudanese pounds (7-8 US dollars). Many patients did not afford the cost and never returned. This financial problem was the main reason for interrupting the study several times.

Conclusions

Abscess drainage forms the bulk of surgical emergency operations in our hospital and is increasing. Most abscesses occur in the young and those who have no known predisposing factors.

The significance of this study is the finding of a high prevalence of CA-MRSA in the pus drained from these patients. This could explain the observed increasing numbers of patients with superficial abscesses presenting to hospital casualties in Khartoum area. Appreciable number of patients present with recurrent abscesses. This may be largely due to inadequate incision, which in turn is due to inadequate anaesthesia.

The high proportion of CA-MRSA also indicates the magnitude of the abuse of antibiotics in the community, since *Staph. aureus* in the pus cultured also showed resistance to many of the other commonly used antibiotics. Health education and other approaches are urgently needed to reduce antibiotic resistance in the community.

The significant number of CA-MRSA calls for further studies on its types, epidemiology and antibiotic susceptibilities. We strongly recommend the adherence to that the practice of performing culture and susceptibility testing of the pus obtained from abscesses in this era of emerging and changing of resistant micro-organisms. Policy makers must provide this service in public hospitals free or at a reasonably subsidized fee.

It is to be stressed that surgical incision and

drainage of an abscess is the only treatment. Antibiotic may be used only in the early inflammatory (cellulitis) stage to abort the formation of abscess or to prevent recurrence after drainage especially in the diabetics and other immune-compromised patients.

Guidelines of I & D of abscesses must be established and followed in all hospitals. These must standardize the procedure and the type of anaesthesia used, and provides senior supervision.

Financial support is lacking in Sudanese medical practice. Governmental institutes, such as universities and the Ministries of Health and High Education, as well as private institutes, such as pharmaceutical companies are invited to encourage further studies and clinical research in order to forward science and improve health service.

Declaration

The lead author declares no affiliation with any company or commercial interest. This study was totally personally financed. A proposal for a bigger study has been submitted to the Ministry of Higher Education.

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