

**Antibiotics susceptibility profile of *Escherichia coli* isolates from suppurations at the referral hospital of Bobo-Dioulasso, Burkina Faso**

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**Abstract**

**Background:** This study aimed to investigate on the antibiotics susceptibility profile of *Escherichia coli* isolates from suppurations at the Sourô Sanou University Hospital Centre.

**Methodology:** A descriptive cross-sectional study was conducted from January 1<sup>st</sup> to December 31<sup>th</sup>, 2020 at the Sourô SANOU University Hospital Centre, the referral hospital of Bobo-Dioulasso. Pus samples of in-patients were collected and subjected to cytological and bacteriological tests.

**Results:** Of 552 specimens processed in this study, 324 were culture- positive. The prevalence of *E. coli* infections was 17.64% [95% CI: 14.66 – 21.06] in the suppurations. Male sex was predominant with a sex ratio of 1.5. The age group [20-24 years] was the most affected and accounted for 10.30%. *E. coli* infections were more frequent in the surgery office (50.52%). There was a very good susceptibility of *E. coli* strains to imipenem (96%), amikacin (93%) and gentamicin (52%). But some strains were resistant to Cefotaxim (23%), ciprofloxacin (27%), amoxicillin (7%) and amoxicillin + clavulanic acid (3%). Extended Spectrum beta-lactamase (ESBL) was produced by 34% (33/97) *E. coli* strains.

**Conclusion:** This study pointed out that imipenem, amikacin and gentamicin were active in suppurative infections caused by *E. coli* strains. The prescription of these antibiotics must be rational in the surgery office.

**Keywords:** *Antibiotics, Escherichia coli*, susceptibility profile, suppurations

**Introduction**

Suppurative infections are usually caused by pyogenic bacteria and are characterized by the formation of purulent exudates (pus). Pus is a thick, white or yellowish fluid that may collect and eventually drain from areas of infection (6). Pus is a mixture of altered white blood cells, dead cell debris and bacteria that form when the body's immune system reacts to infection (6). Cytological and bacteriological analyses of pus allow the detection of pathogens responsible for suppurative infections which often lead to high morbidity and mortality. It is estimated that such infections affect less than 2% of all patients who underwent surgery in the United States of America (13). In France, these infections represent 10.2% of nosocomial infections and are ranked third after urinary tract infections, skin and soft tissue infections (11). In Burkina Faso, a survey on the prevalence of healthcare-associated infections at the referral hospital of Ouagadougou showed that infections occurring in surgical ward led to morbidity in 44.45% of cases (21). *E. coli* is responsible for neonatal infections and prostatitis and frequently isolated from various suppurations (9, 18). Ouédraogo et al. on the bacteriological profile of infections in the surgical office of at the Sourô Sanou University Hospital Centre (SSUHC) reported a prevalence of *E. coli* of 30% in the pus samples (14). This study was let in surgery office on behalf of the high number of suppurations samples

notified over there. Indeed, the probabilistic antibiotic treatment of bacterial infections is based on the bacteriological results and susceptibility profiles of the bacterial isolates to antibiotics. This study aimed to investigate on antibiotics susceptibility profiles of *E. coli* isolates from suppurations at the Sourô Sanou University Hospital Centre.

**Methods****Study site**

This study was conducted at the Sourô Sanou University Hospital Center (SSUHC) in Bobo-Dioulasso, which is one of the six (6) university hospital centers in Burkina Faso. It is the referral hospital for health facilities in the regions of High Basins, Waterfalls, Mouhoun Loop and South-West. Bacteriological analyses were performed in the laboratory unit of Bacteriology-Virology office of the SSUHC hosting the reference laboratory for antimicrobial resistance surveillance.

**Study type and period**

This was a descriptive cross-sectional study conducted from January 1 to December 31, 2020 at the SSUHC, the referral hospital of Bobo-Dioulasso.

**Sampling, data collection and inclusion criteria**

A comprehensive sampling was conducted and patients who were requested to perform cytological and bacteriological tests were included in this study. Pus samples were collected using different techniques. Pus from deep parts of body was collected either by

aspiration during surgery or puncture through the skin or mucosa. The collection of pus samples from superficial areas was done either with a needleless syringe or with swabs after cleaning the surface of the suppurative lesions with sterile physiological water and cotton. Socio-demographic and clinical data were collected using laboratory log book of the patients. This study included all patients who had received a medical prescription for a cytobacteriological examination of pus, who had brought the examination report to the laboratory for pus culture and who were not under antibiotics treatment.

#### Cytological examination

It consisted of macroscopic examination and Gram staining. The appearance and color of the pus samples were determined through macroscopic examination. Gram staining was carried out as described by Tripathi and Sapra and oriented on the choice of culture media (19).

#### Bacteriological examination

##### This included bacterial isolation and identification

Bacterial culture was performed on Eosin Blue Methylene agar (EMB) for isolation. Subsequently, which is an isolation medium for enterobacteria in the same time an enrichment was obtained in a heart-brain broth (BCC) was used as enrichment medium for bacteria belonging to *Enterobacteriaceae*. The plating was done using the top-down tight striations method with 10  $\mu$ l inoculating loop. The plates were incubated at 35  $\pm$  37°C for 18 to 24 hours. API 20E (BioMerieux SA, France) was used for the identification of *Enterobacteriaceae* species.

#### Standard antibiogram

The Antibiotics susceptibility Testing (AST) was carried out using the Kirby-Bauer agar diffusion technique according to the recommendations of the French Society of Microbiology (3). The bacterial suspension was prepared with sterile physiological water from a pure strain and compared to Mac Farland 0.5. The bacterial suspension was inoculated on Muller Hinton medium (Liofilchem diagnostic) by swabbing. Antibiotic discs were deposited with sterilized metal forceps on the surface of MH agar. Strains were tested for antibiotic susceptibility testing using cefotaxim 30  $\mu$ g (CTX), the amoxicillin/clavulanic 20/10  $\mu$ g (AMC), imipenem 10  $\mu$ g (IPM), gentamicin 10  $\mu$ g (GEN), ciprofloxacin 5  $\mu$ g (CIP), amikacin 30  $\mu$ g (AK) (Liofilchem diagnostic, Italy). The culture plates were incubated at 35  $\pm$  37°C for 18 to 24 hours. After incubation, the inhibition diameters were measured using a caliper and their interpretation was done according to the recommendations of the CA-SFM (3).

#### Detection of extended-spectrum beta-lactamases (ESBL)

ESBL detection was performed by the so-called "champagne cork" synergy image search between the beta-lactamase inhibitor disc AMC 20/10  $\mu$ g brought together with a CTX 30  $\mu$ g disc according to CA-SFM recommendations.

#### Quality control

The quality control of the tested antibiotic disks and culture media was done using the reference strains *E. coli* ATCC 25922 for susceptible bacterial strains and *K. pneumoniae* ATCC700603 for resistant bacterial strains according to the recommendations of the CA-SFM

#### Ethical considerations

The authorization of the General Director of the SSUHC was sought for data collection. Also, the authorization of the chief of laboratory of bacteriology and virology was obtained. Anonymity and confidentiality with respect to the data collected from the patients were observed throughout and after this study. Finally, Antibiotics susceptibility test results were forwarded to the attending physician to correct any resistance to the antibiotics initially introduced.

#### Data analysis

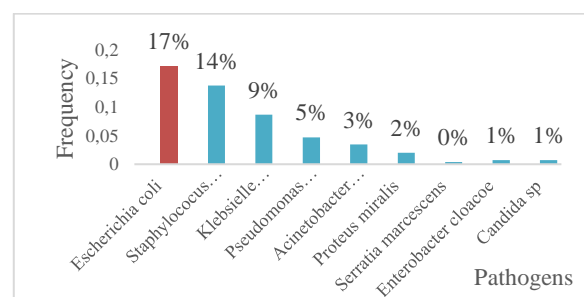
Data analysis was performed with Microsoft Excel 2016 software. Quantitative variables were expressed as median and qualitative variables as proportions.

#### Results

A total of 552 pus samples was included in this study.

##### Prevalence of suppurative *Escherichia coli* infections

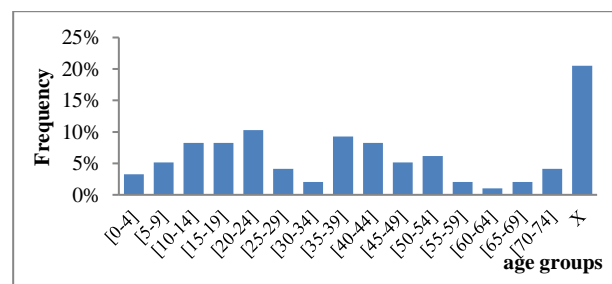
Of 552 pus samples analyzed, 324 were culture-positive. Following identification of the strains, 17.64% [95% CI: 14.66 – 21.06] were *E. coli* (Figure 1).



**Figure 1:** Distribution of *Escherichia coli* strains in suppurative infections

##### Socio-demographic characteristics of patients with suppurative *Escherichia coli* infections

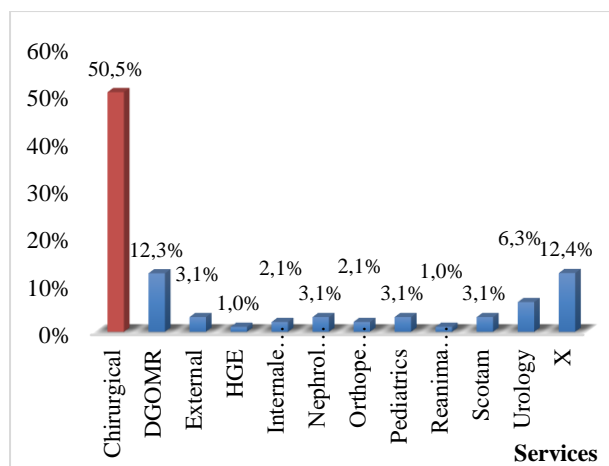
Of 97 patients with *E. coli* infections, there was a predominance of males (58 males) with a sex ratio of 1.5. The age groups [20-24] was the most affected and accounted for 10.30%. (Figure 2).



Legend: X: unknown age group

**Figure 2:** Distribution of *Escherichia coli* suppurative infections by age group

The age groups [20-24] was the most affected and accounted for 10.30%. (Figure 3).



Legend: DGOMR: Department of Gyneco-Obstetrics and Reproductive Medicine, HGE: Hepato-Gastroenterology

**Figure 3:** Distribution of *Escherichia coli* from suppurative infections by department

**Antibiotics susceptibility profile of *Escherichia Coli* isolated from suppurative infections**

There was a very good susceptibility of *E. coli* strains to imipenem (96%), amikacin (93%) and gentamicin (52%). But the strains were resistant to Cefotaxim (23%), ciprofloxacin (27%), amoxicillin (7%) and amoxicillin + clavulanic acid (3%). Extended Spectrum beta-lactamase (ESBL) was produced by 34% (33/97) *E. coli* strains (Table 1).

**Table 1: Antibiotics susceptibility profile of *Escherichia coli* strains**

Antibiotics	Frequency (%)	Susceptibility profile
Amoxicillin + clavulanic acid	3.1	R
Cefotaxim	22.7	R
Amoxicillin	7.2	R
Imipenem	95.9	S
Amikacin	92.8	S
Ciprofloxacin	26.8	R
Gentamicin	52.0	S

R: resistant; S: sensitive,

**Discussions**

This study aimed to investigate the antibiotic susceptibility profiles of *E. coli* isolates from suppurations at the Sourô Sanou University Hospital Centre (SSUHC). A prevalence of 17.64% [95% CI: 14.66 – 21.06] of suppurative *E. coli* infections was found in this study. The majority of suppurative *E. coli* infections were observed in males and in patients in the age group of 20-39 years old. The antibiotic resistance profile shows that Imipenem and Amikacin are active in suppurative *E. coli* infections. However, their use must be rational in the case of infections due to multi-resistant bacteria. The prevalence of 17.64% [95% CI: 14.66 – 21.06] of suppurative *Escherichia coli* (*E. coli*) infections was high in this study. Ouédraogo *et al.* also found the predominance of *E. coli* strains (30%) in their study on the infections occurring in the surgical ward in

Burkina Faso (14). Indeed, this bacterium is one the predominant microorganisms associated with postoperative surgical site infections, along with *Klebsiella species*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* because *E. coli* may be more virulent and produce toxins or enzymes that damage the tissues and lead to pus formation (4, 10), (MSD Manual Professional.). In addition, *E. coli* is more prevalent in the hospital environment or patients’ flora increasing the risk of exposure and transmission (10). Males were mainly affected by suppurative infections caused by *E. coli* strains in this study. Our results are in agreement with those reported by Bassolé who also noted a male predominance in his study on the bacteriological profile of post-operative suppurations in the emergency departments of surgery and trauma departments with a sex ratio of 1.6 (2). These infections affect mainly males because male gender (men and boys) is frequently subjected to road accidents and work incidents (1,2). The distribution of suppurative infections by age group showed a higher frequency of *E. coli* in-patients with ages ranging from 20 to 24 years (10.30%) and from 35 to 39 years with (9.27%), respectively. These results could be attributable to high-risk exposure of these age groups to road accidents and traffic injuries as defended by Pakhat and Gupta in India (16). Regarding the most affected hospital wards by *E. coli* suppurative infections, of the majority of the suppurative infections 50.52% occurred in the department of surgery of SSUHC of Bobo-Dioulasso. Our result is similar to that of Compaoré *et al* who reported a rate of 31.93% (5). There is evidence that *E. coli* is the most common microorganism involved in digestive and visceral surgical infections (17). This could be due to unfavorable hygiene conditions of the different surgical procedures and the complications of surgical site infections. Concerning antibiotics susceptibility profile, *E. coli* isolates showed good susceptibility to a carbapenem antibiotic (IMP: 96%) and aminoglycoside antibiotic (AK: 93%, CN: 52%). Similar results were reported by Ouattara *et al.* in Burkina Faso who found good susceptibility of this bacterium to imipenem (95.74%) and gentamicin (96.96%) (Ouattara, 2001). Eddlimi *et al* in Tunisia reported similar results (Eddlimi *et al.*, 2006). However, resistance was observed with beta-lactam antibiotics (AMC: 3%, AX: 7%, CTX: 23%) and quinolones (CIP: 27%). These resistances could be due to the excessive and inappropriate use of these antibiotics in the treatment of both hospital and community bacterial infections. Ouédraogo *et al.* in Burkina Faso also found similar results for AMC and AX with resistance rates of 10.8% and 5.1%, respectively (14). This high rate of resistance demonstrates the extent of the phenomenon of antibiotic resistance, which is favored by the abusive use of antibiotics in our health structures, but also by self-medication. The frequency of ESBL-producing *E. coli* strains was 30% in this study. The expression of ESBL resistance genes can be associated with various species belonging to the Enterobacteriaceae family, particularly in *K. pneumoniae* and *E. coli* (7). Hospital-acquired



infections caused by enterobacteria with these enzymes pose a real therapeutic problem due to multidrug resistance and the limited choice of antibiotic molecules available on the market (15).

### Conclusion

This study focused on the antibiotics susceptibility profile of *E. coli* in suppurations and pointed out that imipenem, amikacin and gentamicin were active in suppurative infections caused by *E. coli* strains. The strains were resistant to amoxicillin, amoxicillin + clavulanic acid, Cefotaxim, and ciprofloxacin; and there was predominance of suppurative infections in surgical office. Rational prescriptions of antibiotics based on microbiological data is recommended in surgical offices to preserve the activity of antibiotics. Also, It's important to inform all healthcare providers and patients of the risks that could result from the misuse of antibiotics.

**Conflict of interest: None**

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