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A Review of Clinical Manifestations of Gangrene in Western Uganda

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1. Introduction

1.1. Definition

Gangrene is described as the necrosis or death of soft tissue due to obstructed circulation, usually followed by decomposition and putrefaction (Vitin 2011).

It may also be defined as irreversible tissue or organ death caused by loss of blood supply to the affected area. It is a serious and potentially life-threatening medical condition that has significant economic burden worldwide [Hall *et al.*, (2011)].

1.2. Etiology and risk factors

Gangrene is primarily caused by diminished or total loss of blood supply to body tissues that leads to cell death. The compromised blood supply may result from trauma, serious injury, surgery, infection or chronic vascular diseases and immunosuppression. Other risk factors include diabetes mellitus, human immunodeficiency virus infection, long term smoking, alcoholism, malignancies, liver and renal diseases [Czymek *et al.*, 2009]. Multiple digital gangrene has been reported to result from traditional therapy [Unuigbe *et al.*, 2009].

1.3. Prevalence and incidence

The prevalence and incidence of gangrene are difficult to establish [Vivek, 2011] because some patients may die from gangrene and its complications without visiting healthcare facilities, especially among poor rural dwellers with few or no healthcare facilities. For example, though Fournier's gangrene has been widely reported to be commoner among

males [Ndubisi and Raphael 2011, Kim 2011 and David 2011], Czymek et al (2009) found Fournier's gangrene to be more common in females. Among those who visit health centres, the diagnosis may be missed and when diagnosed correctly, it may not be recorded in patients' hospital records. A patient's operation notes may capture gangrene, but the main operating theatre registration book and ward records may only reflect titles like intestinal obstruction, exploratory laparotomy, acute abdomen, etc. In addition, the prevalence and incidence of gangrene are closely related to the known causes and risk factors. These are chiefly non-communicable diseases (NCDs) like chronic cardiovascular diseases (e.g. arteriosclerosis) and diabetes mellitus. There is high prevalence of people with NCDs [Agwu et al (2011)] who do not know that they have the diseases. Such people have higher risk of developing complications associated with the NCDs and one of such complications is gangrene. Gangrene can affect all age groups and sexes.

1.4. Types

There are two major types of gangrene – dry and wet gangrene [Charles 2012]. Gas gangrene, sometimes listed as a third type of gangrene in some texts is actually a type of wet gangrene. Other types of wet gangrene include necrotizing fasciitis and internal gangrene. Gangrene may affect superficial (in the skin or near the skin) or deep tissues (beneath the skin). Superficial gangrene often affects distal parts of the body like toes and fingers. It can also affect the penile shaft or scrotal skin. However, gangrene can also affect deep body tissues and organs.

1.5. Clinical manifestations

Gangrene may be diagnosed from its clinical manifestations, especially when it affects superficial body parts. However, gangrene affecting deep tissues may sometimes be difficult to diagnose from clinical manifestations. Some cases of gangrene are diagnosed at surgery e.g. gangrenous bowel loop. The clinical manifestations of gangrene depend on a number of factors which include type of gangrene, location in the body, cause and underlying disease processes in the affected person [Charles 2012]. Early diagnosis of gangrene is important in curbing local disease progression and its systemic complications which are often fatal. Though superficial gangrene may be easily diagnosed by clinicians, some people are unaware they live with it. Some present with other medical conditions and their gangrene is diagnosed incidentally.

1.6. Treatment

The definitive treatment for gangrene is surgical excision of the affected tissues. Where distal extremities like toes, fingers or distal parts of the lower limbs are affected, the treatment is amputation. However, when deep tissues like intestines are gangrenous, bowel resection and anastomosis is done. Though this may not leave the patient with a physical disability, functional challenges sometimes develop, especially when long lengths of bowel are resected. Awori and Atinga in 2007 reported that diabetes-related gangrene alone accounted for 17.5% of patients who underwent amputation in Kenya. Penectomy has been reported for penile gangrene [Chiang *et al.* 2008].

2. Problem statement

The prognosis of gangrene is highly dependent on early detection of its clinical manifestations, diagnosis and institution of appropriate treatment. Early detection of clinical manifestations of gangrene remains a challenge to healthcare providers due to limited resources. There was therefore a need to document the practical clinical manifestations of gangrene in South-Western Uganda so that evidence based data-base could be generated for use in gangrene diagnosis with the ultimate goal of improving the current capacity to diagnose gangrene in resource limited settings. In this chapter, we therefore focused on how gangrene manifests in South-Western Ugandan communities.

3. Objectives and relevance

In this chapter, we documented the clinical presentations of gangrene in medical records of patients who were diagnosed and managed for gangrene in South Western Uganda from May 2010 to April 2012. Ultimately, this chapter was aimed at alerting health-workers on how gangrene manifests in our practice area and helping promotion of its early diagnosis. This information shall hopefully open new grounds for further research on how patients with gangrene present to healthcare institutions and promote health education that can lead to reduction in the prevalence of gangrene.

4. Methodology

4.1. Study area

Bushenyi, Sheema and Rubirizi Districts of South Western Uganda were chosen for this study. The biggest hospital in each of the three Districts were chosen because they receive the highest number of patients in each of the Districts. These hospitals were Kampala International University Teaching Hospital (KIUTH), Kitagata Hospital (KH) and Rugazi Health Centre (RHC). These sites were carefully selected to represent the varied diversities present in the region. Also, they were selected because they provide free medical healthcare services and they are patronized by many members of the community. They also receive referrals from lower government owned and private healthcare units. In addition, KIUTH is one of the major referral centers in the region that receives patients directly from her community and referrals from many healthcare units within and outside the western region, including neighboring countries like Democratic Republic of Congo and Rwanda.

4.2. Ethical considerations

Ethical clearance was obtained from the Institutional Research and Ethics Committee of Kampala International University before the study was commenced. Permission to access the

files of patients was sought and obtained from the heads of each health facility used. The heads of the hospitals were assured of confidentiality of their patients' identity and only the data without their identity would be published for knowledge transfer and research purposes.

4.3. Sample Size

Medical records of all patients diagnosed to have gangrene within the selected health facilities from May 2010 to April 2012 were used for the study.

4.4. Inclusion criteria

All patients' medical records that had the term "gangrene" in the diagnosis(es) and differential diagnosis(es) within the study timeframe were included.

4.5. Exclusion criteria

All medical records that did not have the term "gangrene" in their diagnosis(es) and differential diagnosis(es) were excluded.

4.6. Data collection instruments

Data sheets were designed and used for the study. They were pre-tested at KIUTH for validity before using them for the study. The research instruments were designed for collection of both qualitative and quantitative data. The data collected included variables like age, sex, education level, occupation, complaints, duration of complaints and treatment received before visiting healthcare facility. Others included type of gangrene and disclosure of diagnosis to patients by hospital staff.

5. Data collection

5.1. Data collection procedure

Hospital file numbers of all patients whose diagnosis(es) contained the word "gangrene" from May 2010 to April 2012 were retrieved from all ward registers of each participating hospital. The case notes/folders were retrieved from the medical records departments of each hospital. Data from patients' records were retrieved by researchers using data sheets.

5.2. Data quality control

All data collection procedures were done by members of the research team. At the end of each data collection session, all members of the research team met to review and resolve challenges encountered during the data collection process. The final data were manually entered into Microsoft Excel 2010 package for data analysis.

6. Results

We found a total of 22 patients' case notes/folders that met our inclusion criteria. There were 15, 4 and 3 from KIUTH, KH and RHC respectively. There were 9 cases of dry gangrene and 13 were wet gangrene. Among the wet gangrene cases, 10 started as wounds that later became infected, while 3 started spontaneously and were diagnosed to be Fournier's gangrene. Details of the results are displayed in the tables below.

INSTITUTION	FREQUENCY	PERCENTAGE (%)
KIUTH	15	68.2
KH	4	18.2
RHC	3	13.6
TOTAL	22	100.0

Table 1. Number of patients with gangrene per healthcare unit

The highest percentage (68.2%) of cases was found in KIUTH followed by KH (18.2%) and then RHC (13.6%) as shown in table 1.

SEX	FREQUENCY	PERCENTAGE (%)
MALE	14	63.6
FEMALE	8	36.4
TOTAL	22	100.0

Table 2. Sex distribution of patients

Table 2 above shows that more males (63.6%) suffered from gangrene, compared to 36.4% seen among females.

TYPE OF GANGRENE	FREQUENCY	PERCENTAGE (%)
DRY	9	40.9
WET	13	59.1
TOTAL	22	100.0

Table 3. Type of gangrene

Table 3 above shows that there were more cases of wet gangrene in the communities studied.

RESPONDENTS' AGE IN YRS	FREQUENCY	PERCENTAGE (%)
<20	3	13.6
20 - 29	3	13.6
30 - 39	6	27.3
40 - 49	3	13.6
50 - 59	5	22.7
60 - 69	0	0.0
70 - 79	1	4.6
80 - 89	0	0.0
>90	1	4.6
TOTAL	22	100.0

Table 4. Age distribution of patients with gangrene

Table 4 above shows that most patients (27.3%) with gangrene were aged between 30 and 39 years. The next age was those between 50 and 59 years (22.7%).

The age distribution of patients affected by gangrene is presented in Figure 1 below. It gives a pictorial view of the age distribution of patients that bear the burden of gangrene.

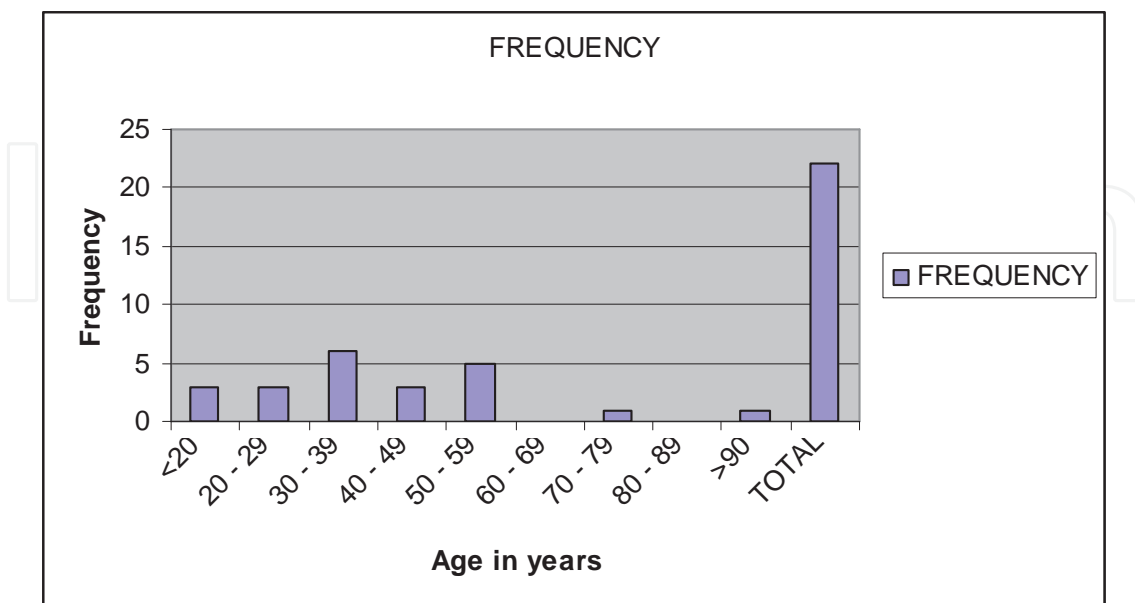


Figure 1. Histogram of Age distribution of patients with gangrene

OCCUPATION	FREQUENCY	PERCENTAGE (%)
STUDENT	3	13.6
TEACHER	1	4.6
FARMER	11	50.0
BUSINESS PERSON	3	13.6
UNKNOWN	4	18.2
TOTAL	22	100.0

Table 5. Occupation of patients with gangrene

Table 5 above shows that most of the patients (50%) that suffered from gangrene were farmers.

COMPLAINT	FREQUENCY	PERCENTAGE (%)
PAIN	20	42.6
LOCAL SWELLING	18	31.9
WOUND	6	12.8
UNCONSCIOUSNESS	3	6.4
UNKNOWN	3	6.4
	47	100.0

Table 6. Presenting complaints of patients with gangrene

Table 6 above shows the main complaints that patients with gangrene reported at the time of visiting the healthcare units. Pain was the commonest complaint (42.6%), followed by local swelling (31.6%) and wounds (12.8%). The 3 patients (6.4%) that were brought to hospital in coma were all diagnosed to have diabetes mellitus.

PREVIOUS TREATMENT	FREQUENCY	PERCENTAGE (%)
YES	8	36.4
NO	14	63.6
TOTAL	22	100.0

Table 7. Previous treatment received by patients with gangrene before visiting healthcare unit

DIAGNOSIS DISCLOSED TO PATIENTS	FREQUENCY	PERCENTAGE (%)
YES	21	95.5
NO	1	4.6
TOTAL	22	100.0

Table 8. Diagnosis disclosure by healthcare staff to patients

Disclosure of information regarding the diagnosis by healthcare workers to the patients was noted to be very encouraging. 95.5% of the patients admitted that they were informed about the diagnosis made by the clinicians.

DURATION OF SYMPTOMS IN MONTHS	FREQUENCY	PERCENTAGE (%)
≤ 1	12	54.6
≤ 2 and > 1	3	13.6
≤ 3 and > 2	1	4.6
≤ 4 and > 3	0	0.0
≤ 5 and > 4	1	5.6
≥ 5	5	33.7
TOTAL	22	100.0

Table 9. Duration of symptoms before presentation to healthcare unit

This study revealed that most patients (54.6%) with gangrene lived with symptoms for one month or less. The figures are shown clearly in Table 9 above.

MANIFESTATION CHANGES	FREQUENCY	PERCENTAGE (%)
YES	5	22.7
NO	17	77.3
TOTAL	22	100.0

Table 10. Changes in clinical manifestations before visiting healthcare unit

Table 10 above shows that majority (77.3%) of those studied did not notice major changes in the clinical manifestations of gangrene from the time of onset till the time they visited hospital for care.

7. Discussion

Gangrene is one of the Non-Communicable Diseases (NCDs) contributing to the morbidity and mortality burden of people in Uganda and Africa in general. The diagnosis of gangrene is made by clinicians in our community, but there is a lot of under-recording in health records. This occurs more commonly among patients with gangrene affecting internal tissues/organs. This has made gangrene not to occupy a prominent position in health reports from Uganda and other parts of the world. It is believed that the situation is similar in many other African countries and beyond. The reality of gangrene only becomes manifest when patients with superficial or peripheral gangrene manifestations are faced with the option of giving informed consent for amputation. This is usually a very challenging moment for patients and their close relatives. In some cases, there is delay in instituting the definitive care (i.e. amputation) due to time required to give adequate counseling to patients and their relatives before they can accept surgery. The economic burden associated with management of gangrene and the post-operative social consequences that result affect patients and relatives' negatively in diverse ways. One such complication is stump wound infection. Obalum and Okeke 2009 reported 26.5% stump wound infection in Nigeria. Surgical care for gangrene accounts for huge financial cost in hospital practice, long hospital stay and significant rehabilitation requirements [Vamos *et al.*, 2010].

It is common knowledge that gangrene is caused by loss of blood supply to tissues. Many causes of blood supply loss are known and preventable. Therefore gangrene can be prevented in many instances. However, when prevention fails, gangrene's debilitating effects can be reduced in many cases if the symptoms and signs are detected early. Early detection and institution of treatment is one of the major ways of reducing morbidity and mortality associated with diseases generally and this is applicable to gangrene. Despite the available knowledge to us today, many people in our community still suffer by living with gangrene for prolonged periods before presenting to healthcare centres for attention.

The results showed that all the patients seen were either incidentally diagnosed to have gangrene or came to the healthcare units to seek medical attention because of worsening condition of their wounds. The results revealed that the highest percentage of cases was found in KIUTH followed by KH and then RHC (Table 1). This was not a surprise, because KIUTH is the biggest and only teaching hospital in the three Districts studied. It also receives referrals from more health units than the other two put together.

From table 2, it was observed that more males (63.6%) had gangrene compared to females. This might have been due to the fact that males do more activities that predispose them to sustaining injuries like farming and technical works.

Table 3 shows a higher prevalence of wet gangrene in the communities studied than the dry gangrene. In essence, this might be a true reflection of the prevalence.

In table 4, it can be seen that the age group that was most affected by gangrene was 30-39 years, followed by 50-59 years and then 20 -29 years; entailing that these are the most active and

productive age groups in any community and therefore will often exert a far-reaching economic and administrative impacts on their respective communities.

Table 5 reveals a higher prevalence of farmers being affected by gangrene. The Districts are mainly occupied by peasant farmers. However, it must be noted here that some of the patients may not have been farmers, because in practice, we find that some traders introduce themselves as farmers in this region since farming is the major occupation of the people.

Table 5 reveals a higher prevalence of farmers being affected by gangrene. The Districts are mainly occupied by peasant farmers. However, it must be noted here that some of the patients may not have been farmers, because in practice, we find that some traders introduce themselves as farmers in this region since farming is the major occupation of the people.

Table 6 shows the main complaints that patients with gangrene reported at the time of visiting the healthcare units. Pain was reported to be the commonest complaint of patients followed by local swelling and then wounds. Three patients (6.4%) were brought to hospital in coma and were all diagnosed to have diabetes mellitus.

From table 7, it was observed that the majority of the patients did not visit any other places to seek medical attention before presenting at the highest hospital in their respective Districts. This might be due to information that they got from staff members of the major hospitals on their usual visits for health talks and home visits in some of the hard-to-reach villages where some of the patients live. It could also have been that those who presented for the first time in the hospitals studied might have had serious pain that they believed could only be managed at the best health facilities nearest to them in the shortest time possible.

In table 8, disclosure of information regarding the diagnosis by healthcare workers to the patients was almost a hundred per cent. This good practice should be encouraged because when patients are well informed about their diagnosis(es), they are empowered to contribute more meaningfully towards the choice of treatment that they eventually receive.

It is noted from this study that most patients with gangrene lived with symptoms for less or equal to one month. The figures are shown clearly in Table 9 above. This might have been due to the discomfort associated with the symptoms they had. It is believed that the three main symptoms that made them to present within the short timeframe were pain, swelling and foul-smelling wounds from Table 6 earlier discussed above.

Table 10 above shows that majority of those studied did not notice major changes in the clinical manifestations of gangrene from the time of onset till the time they visited hospital for care. This is most likely due to the fact that majority of them presented within the first month of onset of the disease. The 5 (22.7%) patients who noted changes in the clinical manifestations before visiting hospitals most likely had dry gangrene which they were able to live with for longer periods. We note that in Table 10 (Changes in clinical manifestations) did not tally with the figure in Table 3 (Type of Gangrene). We believe that several factors might have been responsible for the variation and such factors might include presence of multiple pathology or co-existence of wet and dry gangrene in the same patient in the same location at the same time.

Generally, most of these patients had believed that their leg ulcerations were just like common wounds that heal with time. Even those who noticed darkening of the skin over their toes following tissue death did not know that the affected toes were no longer functional until they were informed by their clinicians. They were able to cope with pain in most cases, hence some of them presented late to hospital. However, some patients had severe excruciating pain that prompted them to even plead with the surgeons to amputate the affected limb in extreme cases.

The health burden associated with gangrene can be minimized if its clinical features are well known to both healthcare workers and the public. As noted earlier, manifestations of the gangrene depend on several factors, including the type, cause, location in the body and associated underlying diseases.

Often, dry gangrene begins with the affected area first becoming numb and cool. The pain experienced depends on patients' pain threshold. The affected area then changes colour, usually turning from reddish to brownish and eventually blackish. While the above processes are taking place, the local area also shrinks and becomes dry. Dry gangrene resulting from immediate arterial blood loss may first turn pale or bluish before progressing as described above [Charles 2012].

On the other hand, wet gangrene commonly starts with swelling and severe pain in the affected area which may be initially red. Putrefaction evidenced by sloughing tissue, pus, local oozing of fluid may follow, associated with a foul odour produced by the infectious agent(s) that destroy(s) the tissues. Both dead and dying tissues later become moist and develop black appearance that is pathognomic of gangrene. Other systemic symptoms often seen in patients with wet gangrene include fever and other signs of severe systemic disease.

It must be noted here that clinicians need to have a high index of suspicion when examining patients that have a high risk of developing gangrene e.g. diabetics, chronic cigarette smokers and immune-compromised patients. Others include patients with chronic ulcers and those with known chronic cardiovascular diseases associated with poor vascular perfusion. It must be noted here that though many people present with the usual classical triad of polyuria, polydipsia and polyphagia, some patients with diabetes mellitus present with coma as the first symptom. This suggests that many more people are quietly living with diabetes mellitus in the communities. If such people are not diagnosed through pragmatic efforts by Government, Non-Governmental Organizations and well-meaning members of the society, the increase in gangrene resulting from diabetes mellitus alone shall continue to rise rapidly in Western Uganda.

All the reports documented in this study have been on superficial or peripheral gangrene. Deep soft tissue gangrene were missed because of the exclusion criteria used that stated that only patients whose diagnosis(es) and/or differential diagnosis(es) clearly included the word "gangrene" were to be used. The figures reported are therefore far below what truly exists in our community. Thus, there is need to critically address the problem of under-reporting in healthcare/health ministry and other ministries in Uganda and other African countries. Special attention needs to be given to surgical findings from our operating theaters in the final

documentation of diseases in all patients' hospital records to enable health planners make proper plans for the people they serve.

8. Conclusions/recommendations

This study has shown that the prevalence of gangrene remains unknown in our community. The report is definitely a tip of the ice-berg regarding the disease burden of gangrene in Western Uganda. Though the numbers are few, the burden is much for anyone that suffers from gangrene. Since the clinical manifestations of deep tissue gangrene may be vague, clinicians are encouraged to have a high index of suspicion in all patients that have risk factors for developing gangrene at any clinician-patient consultation to promote early detection and institution of appropriate preventive and curative measures.

It is also recommended that findings seen during surgical operations should be documented adequately, included in patients' diagnoses and health records as these will reduce the much talked about under-reporting syndrome in developing countries, including Uganda.

Finally, it is recommended that further local prospective studies should be done for longer periods and in more places in Uganda in order to be able to document the true prevalence of gangrene and their clinical manifestations among members of our community. It is believed that such studies shall reveal how early signs and symptoms manifest among Ugandans and other parts of the world.

9. Study limitations

The major limitation of the study was poor documentation of medical findings and poor record keeping. Poor documentation manifested as absence of the term "gangrene" in many patients' records e.g. bowel loop gangrene where diagnoses were simply recorded as acute abdomen or exploratory laparotomy etc.

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