

Research Article

Histo-epidemiological aspects of anorectal cancers in Cameroon

Engbang Ndamba Jean Paul ^{*1,2}, Noah Noah Dominique ¹, Ndjoh Ndjoh Samuel Le Grand ¹, Ateba Gilbert ^{2,4,5}, Simo Godefroy ⁶, Moune André ⁷, Adioogo Dieudonné ¹, Essame Oyono Jean Louis ⁸

¹Faculty of Medicine and Pharmaceutical Sciences, The University of Douala, Douala, Cameroon.

²Laquintinie Hospital of Douala, Douala, Cameroon

³Regional Hospital of Nkongsamba

⁴Douala Gynaeco-Pediatric Hospital, Douala, Cameroon

⁵Pravilna Laboratory, Douala, Cameroon

⁶Bio-Medical and Cancer Center of Bafoussam, Bafoussam, Cameroon

⁷Anapathos Laboratory, Douala, Cameroon

⁸Faculty of Medicine and Biomedical Sciences, The University of Yaoundé I, Yaoundé, Cameroon

Article History

Received: 28.02.2020

Accepted: 12.04.2020

Published: 21.04.2020

Journal homepage:

<http://www.easpublisher.com/easms/>

Quick Response Code



Abstract: Objectives: to determine the epidemiological profile and the histopathological aspects linked to rectal cancers in Cameroon. **Methods:** We undertook a retrospective study for descriptive purposes covering a period of 13 years from January 2004 to December 2016 from the registers of all approved anatomical pathology laboratories in the country (Cameroon). Only histologically confirmed cases were included. The variables studied were frequency, age, sex, risk factors, location and histopathological type. **Results:** Anorectal cancers are the third malignant disease in terms of number of digestive patients with 331 cases observed, or 23.53% of cases, occurring in patients with an average age of $50.62 \pm 17, 21$ years, predominantly at 54.08% for the male sex. The histology was strongly marked at 70% by adenocarcinoma at the rectal level and at 52% by carcinoma at the anal level. Smoking, alcoholism, polyps, consumption of cold meats among others were found to be major risk factors in the majority of cases. **Conclusion:** Malignant anorectal pathologies occupy a significant place in our population. Men remain relatively the most affected population. The dominant histological type is adenocarcinoma on the rectal side and naked carcinoma on the anal level.

Keywords: Cancer; anorectal; epidemiology; histopathology; Cameroon.

Copyright © 2020 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Cancers, globally, are increasing worldwide; digestive cancers account for 20% of the cancers diagnosed annually worldwide. WHO counted 14.1 million new cases with 8.2 million deaths in 2012 (Engbang, J.P. *et al.*, 2012; & Sarker, A. *et al.*, 2014). Colorectal cancer is the third cancer in men and the second in women with an estimated incidence of 1.4 million cases and 693,000 deaths in 2012 (Sarker, A. *et al.*, 2014). In France these figures are estimated at 17,722 deaths out of 42,152 cases of colorectal cancer according to the European Cancer Observatory (OEC) of the International Agency for Research on Cancer (IARC) (Steliarova-Foucher, E. *et al.*, 2012). Anal cancer is very rare and accounts for about 2% of colorectal cancers. Malignancies of the anus are still relatively rare in Canada; very few cases before 35 and are most encountered in the 60s; with 8,080 new cases in 2016 with a sex ratio (W / M) of 5/2 and 1080 deaths (Binder-Foucard, F. *et al.*, 2013). In contrast, colorectal cancer is the second most commonly diagnosed form of cancer with 26,100 new cases in 2016, which represents

13% of all new cancer cases and 9,300 deaths, which represents 12% of all deaths by cancer in 2016, (Arem, H. *et al.*, 2015). In Western Europe and Oceania, rectal cancers fall within the scope of public health concerns acknowledging a high overall frequency with a risk close to 5% and the proportions of affected populations that approaches those observed in North America; namely 2/3 are over 65, women are the most affected in France; The histopathological aspect is dominated by squamous cell carcinoma almost 95% (Gérard, J.P. *et al.*, 2016). On the other hand, in Africa research has been carried out; to classify sub-Saharan Africa as the area with the lowest prevalence (10 per 100,000 inhabitants) of anorectal cancers; especially in the sub-Saharan region and more specifically in West Africa and Congo where the results differ slightly from those encountered elsewhere in the world; a sex ratio of 1.62 in favor of men in the Magreb with an average age of discovery of 47.01 years +/- 15.88 (extreme ages 1-85 years); in sub-Saharan Africa, there is a sex ratio of 1.32 in favor of women with an average age of 34.89

years (1-80 years) (Deby, G. *et al* 2011). Several risk factors have been mentioned and observed in patients who have developed this cancer; namely viruses (HIV and HPV); Personal Habits (smoking, alcoholism, food rich in red meat, sexual habits, etc.); and personal history (age over 50, obesity, presence of colorectal or anal polyps and / or cancer) (Abramowitz, L. *et al.*, 2009; Valmary-Degano, S. *et al.*, 2013; & FNCLCC. 1992). The recent development of endoscopy has made it possible to diagnose this condition at an early stage, supported and confirmed by biopsy and pathological examination. The location of the lesions is preferably rectal (80.25%) and then anal (19.75%); but also that histology is dominated by adenocarcinomas in the rectum (79.01%) and by squamous cell carcinomas in the canal and anal margin (95%) (Engbang, J.P. *et al.*, 2016; Sarker, A. *et al.*, 2014; Frexinos, J. *et al.*, 2005; Steliarova-Foucher, E. *et al.*, 2012; Binder-Foucard, F. *et al.*, 2013; & Arem, H. *et al.*, 2015). In Cameroon, with the exception of the cancer registry for cancer in the city of Yaoundé, which records all cases of cancer diagnosed in this city, very few studies have been carried out concerning this location; considering the increase in the overall incidence of anorectal cancers, it is therefore necessary to describe their epidemiological and histo-pathological profile in our country.

MATERIAL AND METHODS

This is a descriptive and retrospective analytical study of malignant ano-rectal tumors proven

histologically and diagnosed between January 2004 and December 2016. The study was carried out in public and private accredited anatomical pathology laboratories over the extent of the territory. We used histopathological examination reports (registers) from these different laboratories contacted. The samples generally came from surgery, oncology or gastroenterology departments and were fixed at 10% formalin, then treated according to conventional anatomical pathology rules in these approved laboratories. Patients for whom the diagnosis was confirmed were included in the study. The information obtained included the frequency, age, sex, histological type of the tumor. Data entry was made using version 20 of the Social Science Package Software (SPSS). The elements of the descriptive statistics were used to calculate the frequencies and the proportions.

RESULTS

1. General profile of the study population

1.1. Frequency

We have collected a total of 1,407 cases of cancer of the digestive tract from all locations, including 574 cases of stomach cancer (40.80%), 366 cases of colon cancer (26.01%), 89 cases of cancer esophagus (6.33%), 47 cases of ileum cancer (3.34%) and 331 cases of anorectal cancer (17.06%). Cancers of the rectum represented 17.06% of the digestive localizations (240 cases) and cancers of the anal canal 6.47% of the digestive localizations (91cases).

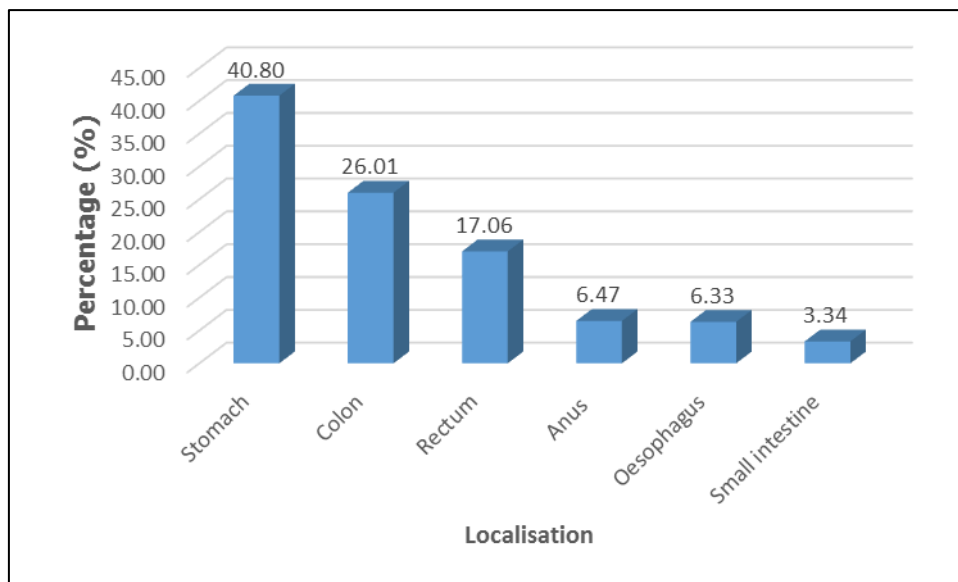


Figure 1. General epidemiology of digestive cancers

1.2. Evolution over the years

The evolution of anorectal cancer is marked by an almost constant increase during the first 7 ranging from 17 cases in 2004 to 38 cases in 2010. The evolution is oscillating the following 6 years with 20 cases in 2012 and 41 cases in 2013, 29 in 2014 ...

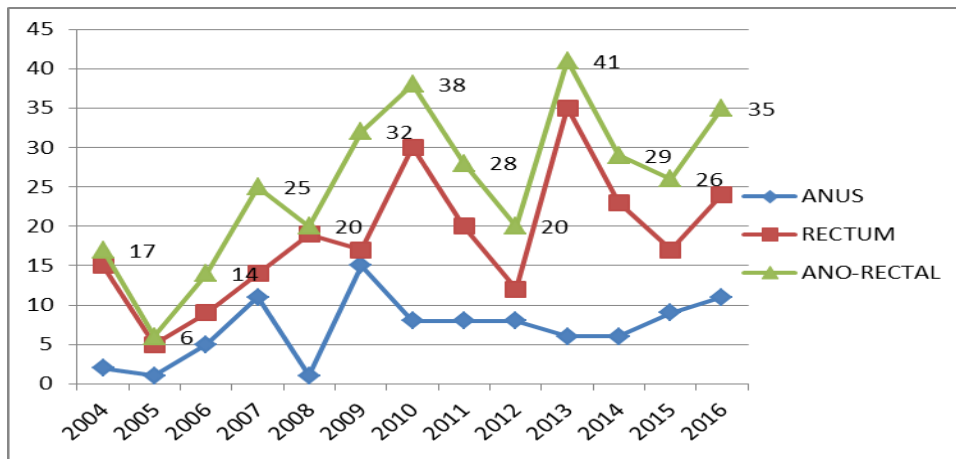


Figure 2. Evolution over the years

1.3. Distribution by sex

Our sample consisted of 331 cases of anorectal cancer with 152 cases (45.92%) respectively for women (42 cases of anal canal cancer and 110 cases of rectal

cancer) and 179 cases (54.08%) for men (49 cases for the anus and 130 for the rectum); or a sex ratio M / F of 1.18.

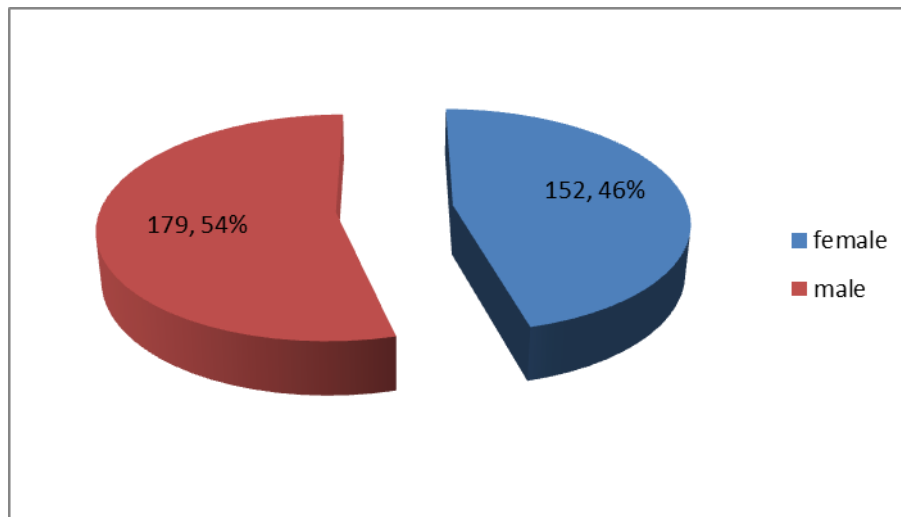


Figure 3. Distribution of populations by sex

1.4. Age distribution

The average age found was 50.62 +/- 17.21 years for extremes of 10-91 years. The modal class at 50-59 years old with 73 cases.

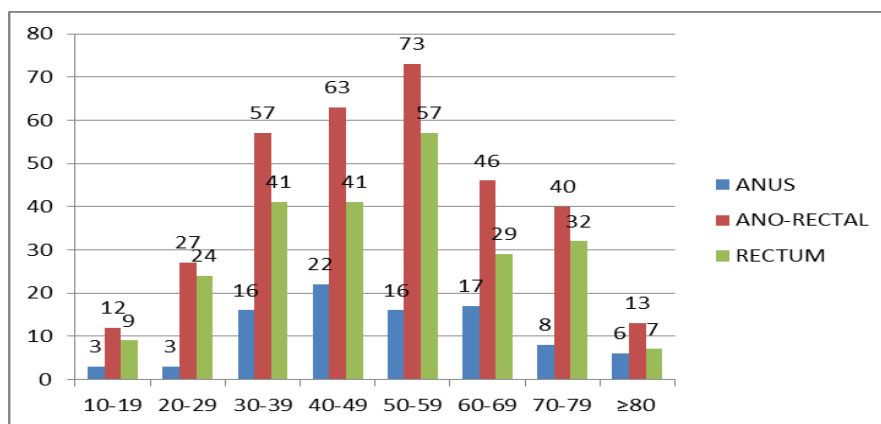


Figure 4. Age distribution of populations

1.5. Distribution of rectal cancer according to the site of collection

The lesions preferably sat at the level of the lower rectum at 40.91%; the Anorectal Junction with 36.36% of the cases each; follow-up of the Recto-sigmoid hinge with 13.64% of cases; and finally in the Upper rectum and the Middle rectum with 4.55% of the cases each.

1.6. Risk factors

They were found in 141 reports on the 331 collected. Smoking was the most represented risk factor with a frequency of 18%, followed by polyposis and ulcerative colitis with respective frequencies of 14% each.

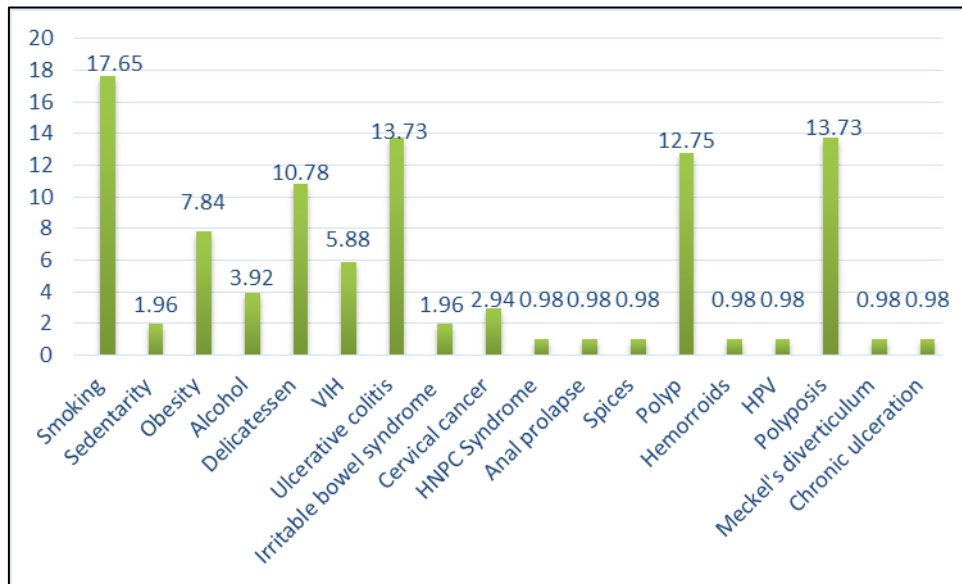


Figure 5. Distribution of populations according to risk factors

2. Anatomopathology

2.1. Type of sample:

The type of sample was documented in 263 cases, out of the 331 collected. The majority of the pieces were obtained from biopsy in 78% of the cases, and from surgical pieces in 22% of the cases.

2.2. Endoscopic / macroscopic aspect

Anal side: The budding form was preponderant (71% of cases). n = 70

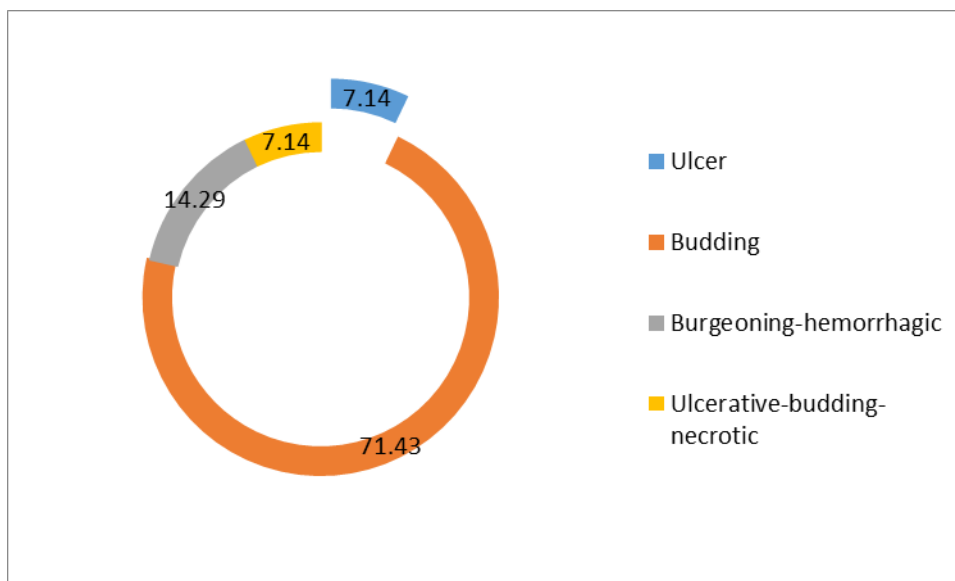


Figure 7. Distribution of anal cancers by endoscopic appearance

Rectum: The budding or polypoid form was the most common (42% of cases). ; n = 152

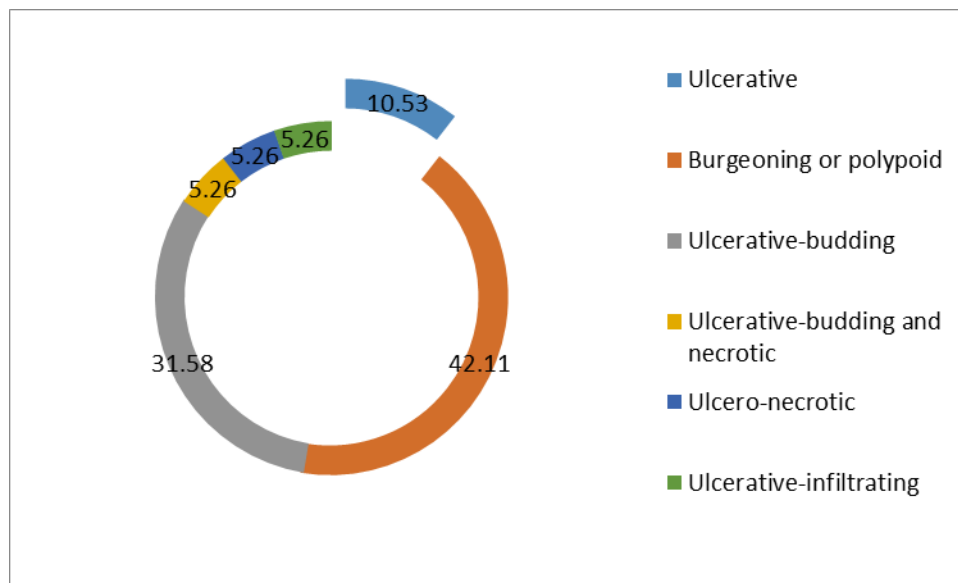


Figure 8. Distribution of rectal cancers by appearance at endoscopy

2.3. Histological type

The rectal histology was dominated by Liberkhunian adenocarcinomas with 70% of the cases.

the other carcinomas, on the other hand, were found mainly at the anal level in almost 52% of cases.

Table I. Distribution of anorectal cancers according to histological types

types	Anus		Rectum		Ano-rectal	
	Effective	%	Effective	%	Effective	%
Liberkhünian adenocarcinoma	35	38.46	168	70	203	61.33
Squamous cell carcinoma	28	30.77	7	2.91	35	10.57
Mucinous carcinoma	13	14.29	31	12.92	44	13.30
Undifferentiated carcinoma	3	3.30	2	0.83	5	1.51
Independent cell carcinoma	/	/	1	0.42	1	0.30
Mixed carcinoma	1	1.10	/	/	1	0.30
Basal cell carcinoma	1	1.10	/	/	1	0.30
Meckel cell carcinoma	1	1.10	/	/	1	0.30
Medullary carcinoma	/	/	1	0.42	1	0.30
Non-Hogkinian Malignant Lymphoma	4	4.40	14	5.83	18	5.44
Kaposi	5	5.49	13	5.42	18	5.44
Leiomyosarcomas	/	/	3	1.25	3	0.91
TOTAL	91	100%	240	100%	331	100%

DISCUSSION

Our study found 331 cases of anorectal malignant tumors over a period of 13 years; this number is different from that found by Edino *et al.*, in Nigeria, 50 cases in 4 years. Padonou *et al.*, in Benin, 4 cases in 7 years and Sani *et al.*, in Niger, 30 cases in 12 years (Edino, S. T. *et al.*, 2005; Padonou, N. *et al.*, 1994; & Sani, R. *et al.*, 2004). Anorectal cancer seems rare in Togo and this rarity is also observed in Africa and in the world (Deans, G. T. *et al.*, 1994; Amegbor, K. *et al.*, 2008; Blanchard, P. *et al.*, 2010; Buchs, N. C. *et al.*, 2008; & Dangou, J.M. *et al.*, 2000). This difference in enrollment could be explained by the relatively longer study duration in our case.

The average age found in our study was 50.62 +/- 17.21 years for extremes of 10-91 years. These results are similar to those of Deby *et al.*, in Brazzaville, who found an average age: 49 years (40 and 59 years); Amegbor *et al.*, in Togo, observed an average age of 49 years (Deby, G. *et al.*, 2011; & Amegbor, K. *et al.*, 2008). The young age of the patients was found by many authors in Africa and varied between 40 and 53 years (Padonou, N. *et al.*, 1994; Elmernissi, H. *et al.*, 2009; Mrini, K. *et al.*, 2009; & Journal de Chirurgie, Elsevier ; Volume 145, 2008), but in Europe 2/3 of the patients diagnosed were over 65 years old according to GLOBOCAN.

The relative youth of our study populations could be explained by the lower life expectancy in Africa and Cameroon where, according to the central bureau of census and population studies, life expectancy in 2014 is estimated at 55,49 years; unlike in Europe where the largest majority of patients are over the age of 65 and where life expectancy is 77 years in men and 83 years in women (Bureau Central des Recensements et des Etudes de Population. 2014).

Our sample consisted of 331 cases of anorectal cancers with 152 cases (45.92%) for women and an overall male predominance with 179 cases (54.08%), i.e. a sex / M ratio of 1.18. These data are similar to those of Sani *et al.*, in Niger, who found a male predominance for rectal cancer, as did most of the authors (Edino, S. T. *et al.*, 2005; Padonou, N. *et al.*, 1994; & Sani, R. *et al.*, 2004). This male predominance was also observed in the studies of Deby *et al.*, Sani *et al.*, for anal cancer (Deby, G. *et al.*, 2011; & Sani, R. *et al.*, 2004). In the literature, however, anal cancer generally occurs in women (Peiffert, D. *et al.*, 2006; Spano, J. P. *et al.*, 2000; & Mir, K. *et al.*, 2009). This male predominance has been studied in the literature; and one of the explanations could be the protective role of estrogen at the colonic level which would decrease the risk of occurrence of anorectal cancer in women compared to men; and also it could be explained by the fact that men would be more smoking and more alcoholic than women and would therefore be more in contact with these risk factors (English, M. A. *et al.*, 1999; & English, M. A. *et al.*, 2001). This increased vulnerability of men to the development of colorectal cancer may be due to a number of biological and gender-related (behavioral) factors (Cook, M. B. *et al.*, 2011; & Edgren, G. *et al.*, 2012). Men are more likely to eat a high diet of red and processed meat, be more heavy consumers of alcohol and more likely to smoke (Bates, B. *et al.*, 2016; Schütze, M. *et al.*, 2011; & Chang, L. C. *et al.*, 2014). Men also have a greater propensity to deposit visceral fat which is associated with an increased risk of colorectal cancer (Tchernof, A., & Després, J. P. 2013; & Marino, M. *et al.*, 2011).

Smoking was the most represented risk factor found in 18% of cases, followed by polyposis and ulcerative colitis in almost 14% of cases. Guingané *et al.*, had similar results in Burkina Faso; as do many authors in the literature (Guingané, A.N. *et al.*, 2014; Chango, A. 2010; Saurin, J-C. 2008; & Spano, J. P. *et al.*, 2006). Epidemiological studies in the literature indicate that meat consumption, smoking and alcohol consumption are risk factors. However, plant anti-cancer agents such as folate, antioxidants and inducers of detoxifying enzymes, binding luminal carcinogens, the fermentation of fibers could promote volatile protective fatty acids, and thus reduce the contact time with the colorectal epithelium due faster transit (Hamilton, S. D *et al.*, 2000). With regard to alcohol,

this product can induce the expression of enzymes linked to the metabolism of carcinogens and of compounds other than ethanol. alcoholic beverages can have carcinogenic effects. Acetaldehyde, an alcohol oxidation product, may be responsible for colorectal carcinogenesis (Wang, Y. *et al.*, 2015). Homann and colleagues have reported that high levels of acetaldehyde in the rat colon degrade folate, a nutrient believed to reduce the risk of colorectal cancer (Homann, N. *et al.*, 2000). Also, alcohol is an antagonist of methyl metabolism group and may contribute to abnormal DNA methylation, an early stage of colon carcinogenesis (Choi, S. W. *et al.*, 1999). Finally, greater alcohol consumption may indirectly increase the risk of colorectal cancer by immunosuppression, delay DNA repair, activate hepatic procarcinogens by induction of cytochrome P-450 enzymes or modify the bile acid composition (Wang, Y. *et al.*, 2015).

Other risk factors found in our study have been studied in the literature. Human papillomavirus (HPV) type 16 is classified by the IARC as a cause of anal cancer, and types 18 and 33 of HPV are classified as probable causes of anal cancer, based on limited evidence (International Agency for Research on Cancer. 2019). It is estimated that 90% of anal cancers in the UK are linked to HPV infection (Parkin, D.M. 2011). About 91% of anal cancers in women and 75% in men are HPV-positive, a meta-analysis has shown (De Vuyst, H. *et al.*, 2009). Risk of anal cancer may be higher in people involved in anal sex behaviors (including but not limited to receptive anal sex), therefore, risk of anal cancer is higher in men who have sex with men (MSM) than other men.

In our study, we found the budding form as the majority diagnostic form in almost 57% of cases. These figures are close to those of Guingane *et al.*, who found the endoscopic aspect most frequently observed was budding tumors with 12 cases (60%); in accordance with data from the literature. According to these authors, all parts of the rectum can therefore be the site of tumor lesions (Guingané, A.N. *et al.*, 2014). In our study, the most frequent site was the lower rectum in almost 41% of the cases. On the other hand, cancer of the anal margin is not taken into account in the studies of many authors because it is considered today as part of dermatological tumors.

We found in our study that histology at the rectal level was almost 70% dominated by Liberkhunian adenocarcinomas. Figures approximating those of Guingane *et al.*, in Burkina, they found a prevalence of 94% (Guingané, A.N. *et al.*, 2014). The predominance of adenocarcinoma at the rectal level has been noted by the vast majority of authors; it is due to the richness of the rectal mucosa in the Lieberkühn gland; but also in one hand its anatomical proximity to the colon and on the other hand its histological

proximity too. Thus, it will be easier to develop adenoacarcinoma due to the colonic type epithelium and risk factors such as the presence of polyps which are pre-cancerous lesions (Edino, S. T. *et al.*, 2005; Padonou, N. *et al.*, 1994; Sani, R. *et al.*, 2004; Deans, G. T. *et al.*, 1994; Amegbor, K. *et al.*, 2008; Blanchard, P. *et al.*, 2010; Choi, S. W. *et al.*, 1999; Matuchansky, C. 1993; & Ioannidis, O. *et al.* 2012).. At the anal level, we mostly had carcinoma at almost 52%; just like Guingane *et al.*, in Burkina and most authors around the world (Buchs, N. C. *et al.*, 2008; Guingané, A.N. *et al.*, 2014; & Ioannidis, O. *et al.* 2012). This would be explained by the histology of the canal and the anal margin which is a non-keratinized squamous epithelium devoid of glands.

REFERENCE

1. Abramowitz, L., Mathieu, N., Roudot-Thoraval, F., Lemarchand, N., Bauer, P., Hennequin, C., ... & Sobhani, I. (2009). Epidermoid anal cancer prognosis comparison among HIV+ and HIV- patients. *Alimentary pharmacology & therapeutics*, 30(4), 414-421.
2. Amegbor, K., Napo-Koura, G. A., Songne-Gnamkoulamba, B., Redah, D., & Tekou, A. (2008). Epidemiological and pathological aspects of gastrointestinal tumors in Togo. *Gastroentérologie clinique et biologique*, 32(4), 430-434.
3. Arem, H., Pfeiffer, R. M., Engels, E. A., Alfano, C. M., Hollenbeck, A., Park, Y., & Matthews, C. E. (2015). Pre-and postdiagnosis physical activity, television viewing, and mortality among patients with colorectal cancer in the National Institutes of Health–AARP diet and health study. *Journal of Clinical Oncology*, 33(2), 180-188.
4. Bates, B., Cox, L., Nicholson, S., Page, P., Prentice, A., Steer, T., & Swan, G. (2016). National Diet and Nutrition Survey results from years 5 and 6 (combined) of the Rolling Programme (2012/2013–2013/2014). London: Public Health England.
5. Binder-Foucard, F., Belot, A., Delafosse, P., Remontet, L., Woronoff, A.S., & Bossard, N. (2013). Estimation nationale de l'incidence et de la mortalité par cancer en France entre 1980 et 2012. Partie 1 – Tumeurs solides. Saint-Maurice (Fra) : Institut de veille sanitaire. 1Disponible sur : <http://www.invs.sante.fr>.
6. Blanchard, P., Levy, A., Breunot, J., Michaud, S., Delmas, V., & Hennequin, C. (2010). Le cancer du rectum. *Cancer/Radiothérapie*, 14, S111-S119.
7. Buchs, N. C., Schneider, D., & Roche, B. (2008). Cancer du canal anal. *Rev Médicale Suisse*; 4 (151): 859-863.
8. Bureau Central des Recensements et des Etudes de Population. (2014). Rapport national sur l'état de la Population : édition 2014. <http://www.bucrep.cm/index.php/fr/component/phocadownload/category/60-rnep-2014>
9. Chang, L. C., Wu, M. S., Tu, C. H., Lee, Y. C., Shun, C. T., & Chiu, H. M. (2014). Metabolic syndrome and smoking may justify earlier colorectal cancer screening in men. *Gastrointestinal endoscopy*, 79(6), 961-969.
10. Chango, A. (2010). Les folates dans la prévention et dans le déterminisme du cancer. *J Afr Cancer*, 2 (3), 171-177.
11. Choi, S. W., Stickel, F., Baik, H. W., Kim, Y. I., Seitz, H. K., & Mason, J. B. (1999). Chronic alcohol consumption induces genomic but not p53-specific DNA hypomethylation in rat colon. *The Journal of nutrition*, 129(11), 1945-1950.
12. Cook, M. B., McGlynn, K. A., Devesa, S. S., Freedman, N. D., & Anderson, W. F. (2011). Sex disparities in cancer mortality and survival. *Cancer Epidemiology and Prevention Biomarkers*, 20(8), 1629-1637.
13. Dangou, J.M., Dem, A., Kasse, A., et al (2000). Les cancers de l'anus: A propos de 32 cas colligés à l'Institut du Cancer de Dakar. *Acta Endosc*, 30(3), 255-262.
14. De Vuyst, H., Clifford, G. M., Nascimento, M. C., Madeleine, M. M., & Franceschi, S. (2009). Prevalence and type distribution of human papillomavirus in carcinoma and intraepithelial neoplasia of the vulva, vagina and anus: a meta-analysis. *International journal of cancer*, 124(7), 1626-1636.
15. Deans, G. T., McAleer, J. J. A., & Spence, R. A. J. (1994). Malignant anal tumours. *British journal of surgery*, 81(4), 500-508.
16. Deby, G., Police Camengo, S. M., Atipo, I. B., & Ibara, J. R. (2011). Le cancer anal: aspects épidémiologiques, cliniques, endoscopiques, histologiques et thérapeutiques. *Médecine d'Afrique noire*, 58(1), 41-44.
17. Edgren, G., Liang, L., Adami, H. O., & Chang, E. T. (2012). Enigmatic sex disparities in cancer incidence. *European journal of epidemiology*, 27(3), 187-196.
18. Edino, S. T., Mohammed, A. Z., & Ochicha, O. (2005). Characteristics of colorectal carcinoma in Kano, Nigeria: an analysis of 50 cases. *Nigerian journal of medicine: journal of the National Association of Resident Doctors of Nigeria*, 14(2), 161-166.
19. Elmernissi, H., Hrorra, A., Mrini, K., Benamer, A., Raiss, M., Sebbah, F., & Ahallat, M. (2009). (051). Epidemiologic characteristics of rectal cancers: About 232 cases in a Moroccan hospital unit. *Arab Journal of Gastroenterology*, 2(10), AB28.
20. Engbang, J.P., Fonkwa, C., Ndjoh, N.S., et al. (2016). Aspects histo-épidémiologiques des cancers ano-rectaux à Douala. XXIIIeme journées

- scientifiques de la société camerounaise de gastroentérologie; Sept 22; 2016. Douala
21. English, M. A., Kane, K. F., Cruickshank, N., Langman, M. J., Stewart, P. M., & Hewison, M. (1999). Loss of estrogen inactivation in colonic cancer. *The Journal of Clinical Endocrinology & Metabolism*, 84(6), 2080-2085.
 22. English, M. A., Stewart, P. M., & Hewison, M. (2001). Estrogen metabolism and malignancy: analysis of the expression and function of 17 β -hydroxysteroid dehydrogenases in colonic cancer. *Molecular and cellular endocrinology*, 171(1-2), 53-60.
 23. FNCLCC. (1992). Enquête permanente cancer 1976-1989: Survie à long terme des malades traités pour cancer. Monographie FNCLCC.
 24. Frexinos, J. et al (2005). Masson 5^{ème} édition, Paris.
 25. Gérard, J.P., André, T., Bibeau, F., Conroy, T., Legoux, J.L., & Portier, G. (2016). in Cancer du Rectum. *Thésaurus national de Cancérologie Digestive*.
 26. Guingané, A.N., Sombié, R.A., Bougouma, A. (2014). Les tumeurs malignes anorectales en milieu hospitalier à Ouagadougou: aspects épidémiologiques et diagnostiques *Pan Afr Med J*, 18:26.
 27. Hamilton, S. D., Vogelstein, B., Kudo, S., Riboli, E., Nakamura, S. H., Hainaut, P., Rubio, C. A., Sobin, L. H., Fogt, F., Winawer, S. J., Goldgar, D. E., & Jass, J. R. (2000). Tumours of the colon and rectum: Carcinoma of the colon and rectum. In Stanley R. Hamilton and Lauri A. Aaltonen (Ed.), *World Health Organization Classification of Tumours: Pathology and Genetics of Tumours of the Digestive System* (pp. 105-119) Lyon, France: IARC Press
 28. Homann, N., Tillonen, J., & Salaspuro, M. (2000). Microbially produced acetaldehyde from ethanol may increase the risk of colon cancer via folate deficiency. *International journal of cancer*, 86(2), 169-173.
 29. International Agency for Research on Cancer. (2019). List of Classifications by cancer sites with sufficient or limited evidence in humans, Volumes 1 to 105*. Available from: <http://monographs.iarc.fr/ENG/Classification/index.php>. Accessed october.
 30. Ioannidis, O., Papaemmanouil, S., Paraskevas, G, et al (2012). Primary Signet Ring Cell Anal Adenocarcinoma. *J Gastrointest Cancer*. 43(1), 168-170.
 31. Journal de Chirurgie, Elsevier ; Volume 145, Supplément 4, Décembre 2008, Pages12S40 – 12S43
 32. Marino, M., Masella, R., Bulzomi, P., Campesi, I., Malorni, W., & Franconi, F. (2011). Nutrition and human health from a sex–gender perspective. *Molecular Aspects of Medicine*, 32(1), 1-70.
 33. Matuchansky, C. (1993). Cancer du rectum: aspects épidémiologiques. In *Annales de gastroentérologie et d'hépatologie* (Vol. 29, No. 3, pp. 124-125)
 34. Mir, K., Kochlef, A., & Kilani, A. (2009). Descriptive study of a Tunisian review of rectal cancer. *Arab J Gastroenterol*. 10 (2): AB27.
 35. Mrini, K., Essamri, O., & Benbelbarhdadi, I. (2009). Epidemiologic characteristics of rectal cancer: About a Moroccan experience from teaching hospital. *Arab J Gastroenterol*. 10 (2), AB27.
 36. Padonou, N., Bagnan, K. O., Kodjoh, N., & Agbo, N. (1994). Les cancers colo-rectaux à la clinique universitaire de chirurgie viscérale du CNHU de Cotonou: à propos de 10 cas observés en 7 ans. *Médecine d'Afrique Noire*, 41(5), 300-303.
 37. Parkin, D.M. (2011). Cancers attributable to infection in the UK in 2010 (link is external). *Br J Cancer*, 105 (S2), S49-S56.
 38. Peiffert, D., Brunet, P., Salmon, R., et al. (2006). Cancer of the anal canal (cancer of the anus). *Gastroentérologie Clin Biol*, 30(2), 2S52-52S56.
 39. Sani, R., Dantata, A. R., Bade, M. A., Hassane, N., & Bazira, L. (2004). Les cancers du tube digestif. Revue de 195 dossiers au service de chirurgie digestive de l'hôpital National de Niamey Niger. *Médecine d'Afrique Noire*, 51(11), 585-588.
 40. Sarker, A., Bahar, A. N., Biswas, P. K., & Morshed, M. (2014). A novel presentation of peres gate (pg) in quantum-dot cellular automata (QCA). *European Scientific Journal*, 10(21)..
 41. Saurin, J-C. (2008). La polypose adénomateuse familiale (PAF) atténuée : une entité à connaître. *Gastroentérologie Clin Biol*, 32(5), S158-S165.
 42. Schütze, M., Boeing, H., Pischon, T., Rehm, J., Kehoe, T., Gmel, G., ... & Clavel-Chapelon, F. (2011). Alcohol attributable burden of incidence of cancer in eight European countries based on results from prospective cohort study. *Bmj*, 342, d1584.
 43. Spano, J. P., Atlan, D., Sibony, M., & Scalliet, P. (2000). Le cancer du canal anal: Revue de la littérature. *Bulletin du cancer*, 87(9), 33-46.
 44. Spano, J. P., Carcelain, G., Katlama, C., & Costagliola, D. (2006). Les nouvelles tumeurs malignes du patient infecté par le VIH: aspects cliniques et perspectives. *Bulletin du cancer*, 93(1), 37-42.
 45. Steliarova-Foucher, E., O'Callaghan, M., Ferlay, J., Masuyer, E., Comber, H., & Bray, F. (2012). European cancer observatory: cancer incidence, mortality, prevalence and survival in Europe. Version 1.0 (September 2012) European Network of Cancer Registries, *International Agency for Research on Cancer*.
 46. Tchernof, A., & Després, J. P. (2013). Pathophysiology of human visceral obesity: an update. *Physiological reviews*, 93(1), 359-404.
 47. Valmary-Degano, S., Jacquin, E., Prétet, J. L., Monnier, F., Girardo, B., Arbez-Gindre, F., ... & Mougou, C. (2013). Signature patterns of human

papillomavirus type 16 in invasive anal carcinoma. *Human pathology*, 44(6), 992-1002.

48. Wang, Y., Duan, H., Yang, H., & Lin, J. (2015). A pooled analysis of alcohol intake and colorectal cancer. *Int J Clin Exp Med*, 8(5), 6878-6889.