

Original Research Article

Surgical management and postoperative outcome of patients with gastric pathologies in three hospitals in the city of Douala

Jean Paul Engbang^{1,2*}, Basile Essola¹, Marcel Ralph Ateba¹, Christian Beugheum Chasim³, Gertrude Annie Massom³, Marcelin Ngowe Ngowe^{1,4}

¹Faculty of Medicine and Pharmaceutical Sciences, The University of Douala, Douala, Cameroun

²Douala Laquintinie Hospital, Douala, Cameroun

³Douala General Hospital, Douala, Cameroun

⁴Department of Medicine and Biomedical Sciences, The University de Yaounde I, Yaoundé, Cameroun

Received: 24 February 2022

Revised: 26 April 2022

Accepted: 04 May 2022

*Correspondence:

Dr. Jean Paul Engbang,

E-mail: jean_pen@yahoo.ca

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: To bring out the different surgical approach and to appreciate the post-surgery outcome of patients with gastric pathologies in three Douala's hospitals.

Methods: This retrospective and analytic study has been carryout from January 1st 2010 to November 31st 2019 in three healthcare centers in Douala. Patients' records who had presented a surgical gastric pathology were included in our study and patients with incomplete filled records were excluded. Statistical analysis was been realized by means of the SPSS 23.0.

Results: We selected 158 files of gastric perforation (85.4%), 17 of gastric stenosis (9.2%), and 10 of gastric cancers (5.4%). The mean age of occurrence of gastric perforation in our sample was 42.11 ± 16.5 years and for stenosis was 43.65 ± 23.3 years with a male predominance for these two pathologies. For the cancerous patients the mean age was 54.70 ± 7.5 years with a sex ratio of 1. Simple suture was the most used surgical technique in perforation, pyloromyotomy was done in gastric stenosis. Total gastrectomy and gastrojejunostomy were the most practiced in cancer cases. The death rate varied from 15.8% with perforation to 40% with cancer. The associated factors to complications were age ($p=0.002$) and duration of hospitalization ($p=0,004$) in gastric perforation.

Conclusions: Gastric perforation was the most frequent pathology affecting mostly traders. The surgical approach was thus pathology dependent.

Keywords: Gastric perforation, Stenosis, Cancer, Surgery, Outcome, Douala

INTRODUCTION

Stomach disease is dominated by gastritis, ulcers, and gastric cancers associated with *Helicobacter pylori* infection, which causes progressive inflammatory changes in the gastric mucosa.¹ Long neglected, ulcerative disease is the starting point of several pathologies, in particular gastric perforation, the associated mortality of which is 30%.² Thorsen et al in their study about perforated peptic ulcer, found an adjusted incidence rate for the overall 10-year period was

6.5 per 100 000 per year (95% CI: 5.6-7.6) and the adjusted mortality rate for the overall 10-year period was 1.1 per 100 000 per year (95% CI: 0.7-1.6).³ Gastric cancer remains one of the most common tumors in the world.⁴ It is the 3rd leading cause of cancer death in men and 5th in women.⁵ In North Africa, two studies have shown that pyloric stenosis is a common condition in male infants and that gastric perforations and cancers are the most serious complications found in peptic ulcer disease.^{6,7} According to the college of hepatogastroenterology and digestive surgery, the 5-year

survival after surgical excision of stomach cancer is 60% in the absence of an invaded lymph node, 35% if a lymph node is invaded and 10% if two lymph nodes are invaded.⁸ In pyloro-duodenal stenosis, the surgery indicated is truncal vagotomy.⁹ In addition, in West Africa, a study found that the surgical treatment of stricture consisted of a partial gastrectomy, with gastro-jejunal anastomosis in some cases.¹⁰ Delay in diagnosing stomach cancer makes the prognosis grim.¹¹ In our context, several studies have been carried out, notably that of Ngowe et al which found that perforated gastric ulcer occupies first place in the etiologies of generalized peritonitis.¹² Ankouane et al found that the most common histological type of gastric cancer in Cameroon is adenocarcinoma.¹³

As a result, in Cameroon few studies exist on the surgical and evolutionary aspects of gastric surgical pathologies; it is for this reason that we set out to study "surgical management and post-operative progress of patients with gastric pathologies".

METHOD

This was a retrospective analytical study, conducted from January 1, 2010 to November 31, 2019, in the surgery, oncology, emergencies and anatomy pathology department, of 3 hospitals in the city of Douala, namely general, Laquintinie and military. All records of patients with confirmed gastric surgical pathology, completely treated and followed during the study period were included. Files of non-operated and incomplete files were excluded. Sampling was consecutive including all records of patients meeting the inclusion criteria. We collected socio-demographic, clinical, paraclinical, therapeutic data and those relating to the evolution of patients operated on for gastric pathologies. All these data entered in a pre-tested data sheet. Data were entered and processed using statistical package for social sciences (SPSS) software version 23.0. This analysis was descriptive by the calculations of the parameters of central tendency and dispersion and that of the numbers and percentages. Analytical by the statistical linkage tests (the chi-square test), in finding the different associations between our variables of interests. Odds ratios were calculated and the p significant below 5%.

RESULTS

Epidemiological and diagnostic generalities

Frequency of occurrence of pathologies and sex distribution

As shown in Table 1, the most represented gastric surgical pathology in our population was perforation with 85.5% (158 cases), followed by stenosis with 9.2% (17 cases), and finally cancer with 5.4% (10 cases). The male sex predominated with a rate of 91% in patients with perforation (144 cases), or a male/female sex ratio of

10.2. The male sex was the most represented in the strictures with a rate of 76% (13 cases), or a male/female sex ratio of 3.2. Both sexes are equally affected with 50% of men (5 cases) and 50% of women (5 cases) in the cancer group, a sex ratio of 1.

Age

The mean age of onset of perforation was 42.11 years±16.594 years with the range 11 and 86 years. The 30-39 age group was the most represented with 26% (41 cases). The mean age of onset of stricture was 43.65±23.3 years with ranges of 11-85 years. Patients aged between 50 and 59 years were the most affected with 29.4% (5 cases), followed by groups 30-39 and 10-19 years with 3 cases each. People aged 60-69 were the most affected with 40% (4 cases) followed simultaneously by groups of 40-49 and 50-59 years each with 30% (3 cases) (Table 2).

Table 1: Distribution according to pathology and sex.

Age (Years)	Perforation		Stenosis		Cancer	
	N	%	N	%	N	%
0-9			2	11.8		
10-19	9	5.7	1	5.9		
20-29	29	18.3	1	5.9		
30-39	41	26	3	17.6		
40-49	30	19	1	5.9	3	30
50-59	21	13.3	5	29.4	3	30
60-69	15	9.5	2	11.8	4	40
>69	13	8.2	2	11.8		
Total	158	100	17	100	10	100

Table 2: Distribution according to different age groups.

Variables	Perforation		Stenosis		Cancer		Total
	N	%	N	%	N	%	
Pathology	158	85.4	17	9.2	10	5.4	185
Sex							
Male	144	91	13	76	5	50	
Female	14	9	4	24	5	50	

Treatment

Per-operative findings and surgical techniques gastric perforations

As shown in Table 3, the site of perforation in our series was mainly the anterior surface of the lesser curvature with 39.8% (63 cases). The majority of our patients had a gastric perforation between 0.5 and 1 cm, in particular 68.9% (109 patients). Absent of peritoneal effusion in the majority of patients 77% (123 patients). Simple suture was the most used surgical technique at 55.7% (88 cases), followed by omentum with 27.2% (43 cases), in 3rd position pyloroplasty with 11.4% (18 cases), 4th position was occupied by gastroplasty with 4.4% and bivotomy-pyloroplasty occupy 5th place with 1.3% of cases.

Gastric stenosis

The pylorus was the most found localization in our series with 100%. We found a gastric ulcer in 88.2% (15 patients) of the patients, an enlarged pylorus in 11.8% of the patients (2) and 2 patients with gastric tumor of which we could not determine histology. Pylorotomy performed in 52.9% (9), followed by gastro-jejunoscopy with 17.6% (3), subtotal gastrectomy in 11.8% (2), vagotomy; feeding jejunostomy and bivagotomy-pyloroplasty represented 5.9% (1) (Table 4).

Gastric cancer

It's important to notice, concerning the histopathological type, only adenocarcinoma was found (Papillary and tubular).

As in Table 5, the tumor was more found in the gastric antrum in 40% of cases (4 cases). 50% of patients had a gastric tumor diameter between 5 and 8 cm (5 patients). Gastrojejunoscopy and total gastrectomy are the two most widely used surgical techniques in our series with 30% (3 cases), followed by partial gastrectomy representing 20% (2 cases). Finally, the feeding jejunostomy and the vagotomy represent 10% each.

Table 3: Perforation: distribution according to intraoperative findings and surgical techniques.

Findings	Effective	Percent (%)
Parforation seat		
Anterior perforation of the gastric cavity	13	8.2
Posterior perforation of the gastric cavity	7	4.4
Posterior perforation on the gastric	30	18.9
Anterior perforation of the greater gastric curvature	45	28.4
Anterior perforation of the lesser gastric curvature	63	39.8
Perforation size (cm)		
0.5-1	109	68.9
2-4	49	31.1
Peritoneal effusion		
Small abundance	27	17
Average abundance	5	3.1
Great abundance	3	1.8
Lack of effusion	123	77.8
Surgical techniques		
Suture suture	88	55.7
Bivagotomy-pyloroplasty	2	1.3
Pyloroplasty	18	11.4
Gastroplasty	7	4.4
Epiploplasty	43	27.2

Table 4: Stenosis: distribution according to intraoperative findings and surgical techniques.

Findings	Effective	Percent (%)
Location of the stenosis		
Pylorus	17	100
Other discovery		
Gastric ulcer	15	88.2
Pyloric hypertrophy	2	11.8
Gastric tumor	2	11.8
Surgical techniques		
Pylorotomy	9	52.9
Vagotomy	1	5.9
Gastrojejunoscopy	3	17.6
Subtotal gastrectomy	2	11.8
Feeding jejunostomy	1	5.9
Bivagotomy-pyloroplasty	1	5.9

Table 5: Cancer: distribution according to intraoperative findings and surgical techniques.

Findings	Effective	Percent (%)
Location		
Tumor of the gastric cavity	3	30
Lesser curvature tumor	4	40
Tumor of the greater curvature	1	10
Tumor of the gastric body	2	20
Mass diameter (cm)		
0-1	2	20
2-4	3	30
5-8	5	50
Surgical techniques		
Total gastrectomy	3	30
Partial gastrectomy	2	20
Feeding jejunostomy	1	10
Gastrojejunoscopy	3	30
Vagotomy	1	10

Post-operative evolution

Post-operative complications

As shown in Table 6, for gastric perforations, 65.2% (103 cases) of patients progressed favorably.

The unfavorable course consisted of complications in 19% (30 cases) and death in 15.8% (25 cases).

All the patients with gastric stenosis had a favorable post-operative outcome.

In cases of stomach cancer, 50% of patients had a favorable outcome. Among the 50% of cases with postoperative complications, 40% died (40%).

Factors associated to the post-operative complications

The search for factors that could explain the occurrence of postoperative complications has only given favorable results in the case of gastric perforation.

Univariate analysis

The 40 to 69 years age group is significantly associated with the occurrence of suppuration ($p=0.001$) as well as hospitalization lasting 5 to 15 days ($p=0.002$) (Table 7).

Multivariate analysis

After multivariate logistic regression analysis, it emerges that the age between 40 and 69 years is the factor most significantly associated with the occurrence of suppuration ($p=0.002$) (Table 8).

Table 6: Distribution according to the post-operative evolution.

Variables	Perforation		Stenosis		Cancer	
	N	%	N	%	N	%
Favorable	103	65.2	17	100	5	50
Unfavorable	55	34.8	-	-	5	50
Complications						
Suppuration	13	8.2	-	-	-	-
Abdominal pains	15	9.5	-	-	5	50
Generalized peritonitis	1	0.6	-	-	-	-
Oligoria	1	0.6	-	-	-	-
Death	25	15.8	-	-	4	40

Table 7: Univariate analysis of complications/age and length of hospitalization.

Variables	Suppuration	Douleur abdominale	P
Age (years)			
10-39	1	5	0.175
40-69	9	8	0.001
Durée d'hospitalisation (Hours)			
5-15	9	12	0.002
16- 25	4	3	0.081

Table 8: Multivariate analysis of factors associated with the onset of complications.

Variables	Suppuration	OR (IC)	P
Age (years)			
40-69	9	1.026 (0.990-1.063)	0.002
Durée d'hospitalisation (Hours)			
5-15	9	1.31 (0.33-0.522)	0.004

DISCUSSION

Gastric perforation

In our series, the mean age of patients with gastric perforation was 42.11 ± 16.5 years, the most represented age group was 30-39 years with predominantly male involvement, so it was about a young population. There is a slight difference with a study conducted in Europe by Moller et al who found an age range of between 35 and 47 years.¹⁴ Our population is younger probably due to poor monitoring of food hygiene, thus predisposing to ulcer disease which is the most common starting point for gastric perforation. In North Africa, Adil in 2016 found an age group of 30-39 years with a predominance of males at 98%; which is in line with the results of our study.¹⁵ Several studies are more or less similar to ours, in particular that of Vignon et al in Benin in 2016 who found an average age of 34.2 years with a predominance for the male sex; Ouédraogo et al had a mean age of 44.8 years with a male predominance at 67.4% and at the end of Dodiya-Manuel et al in Nigeria in 2015 found an average age of $42.1 \pm 12, 3$ years with predominance for the male sex.¹⁶⁻¹⁸

The management of perforated gastric ulcer may or may not be surgical, depending on the clinical condition.¹⁹ On the other hand, all of our patients had been treated surgically by laparotomy, whereas in 2007 Guirat et al had found that the treatment of perforated ulcers by laparoscopy had a low rate of morbidity, reoperation and mortality.²⁰ The most used surgical technique was simple suture in 55.7% (88 cases) unlike a study conducted in Morocco by Hamidi who found that truncal bivagotomy was the most used technique and in Nigeria in 2015, the graham patch was used more than other techniques.^{18,21} This could be explained simply by the fact that the choice of surgery is made according to the operator of the technical platform and the findings during the operation.

In our study, the complications were made of abdominal pain at 9.5% (15 cases) and suppuration at 8.2% (13 cases), while in Morocco, Hamidi in his study had found as complications: recurrences at 17%, diarrhea 20%, vomiting 20% and gastroesophageal reflux disease 15%.²¹ Wall suppuration was a frequent complication in our series as well as in several other studies in West Africa.^{17,18} Patients over 40 years of age and the length of hospital stay between 5 and 15 days are factors associated with the onset of postoperative complications in our series, in particular suppuration because a long hospital stay exposes people to nosocomial infections. We had a death rate of 15.8% (25 cases) which was not the case for the study conducted by Kambiré et al in Burkina-Faso in 2017 which found that gastric perforation remains burdened with a heavy mortality.²² This would be related to the delay in treatment, unlike our study in which patients were treated within a maximum of two days after the onset of symptoms.

Gastric stenosis

We found the mean age of onset of stenosis of 43.65 ± 23.3 , the most represented age group was between 50-59 years with predominantly male involvement. Among other things, pyloric stenosis is a common pathology in male infants.⁷ Lopin et al in France in 2018 found an age range of between 3 weeks and 3 months.²³ In Cameroon, Ndongo et al the same year found an average age of onset of stenosis of 5.2 ± 1.2 weeks.²⁴ These results are different from ours firstly because our study was not conducted in a pediatric surgery center, and secondly because the most common etiology of the stenosis were stenosing ulcer more found in adults than in children.

Pylorotomy was the most widely used surgical technique in our series, this corroborates with several studies in the world, especially from Japan by Jia et al in 2011 and in 2012 by Oomen et al using pylorotomy as a safe and effective method.^{25,26} This unanimity on the use of pylorotomy is the fact that it performs better than other techniques from its discovery in 1907 to present day.²⁷

In our population, we had no post-operative complications, which is in line with the study conducted by Binet et al.²⁸ No deaths were also observed in our series, which is close to the results of a study conducted in Togo by Kassegne et al which found low mortality and a good functional prognosis.²⁹ This is probably due to the effectiveness of the surgical treatment.

Gastric cancer

The mean age of cancer onset in our series was 54.70 ± 7.5 years with equal onset in both sexes. This age is lower than that found in the United States by Liu et al which was 78 years.³⁰ This could be explained by the fact that the population in our context is less aging and that older people are a risk factor for cancer disease. In North Africa, patients over 40 years old are considered to be elderly and are most affected by gastric cancer and in Morocco the mean age of onset of stomach cancer is 58 ± 13.4 years with male predominance, unlike our study which found equality of occurrence in both sexes probably because of the small size of our sample.^{31,32} In our series, housewives were the people most affected by gastric cancer with 20% of cases, this is close to what Ezzahraet al had found in Morocco in 2018 saying that attack by gastric cancer higher in disadvantaged social classes.³³

Adenocarcinoma remains the most common histologic type found in stomach cancer. In our study population, adenocarcinoma was found in 100% of cases, which is in line with a study conducted in 2014 in Morocco, according to which gastric adenocarcinoma is the histological type essentially found and in 2015 in Cameroon, Ankouane et al had found that

adenocarcinoma is the most common histological type in gastric cancers in Cameroon.^{13,31}

Laparotomy was also the most used route here, while treatment with laparoscopy was successful in the treatment of gastric duplication in Tunisia.³⁴ Total gastrectomy was one of the most used surgical techniques in our patients, contrary to what Chevally et al had found in saying that subtotal gastrectomy was more beneficial than other techniques.³⁵ This could be explained by the fact that the tumor in our patients was probably more localized in the upper third of the stomach, thus requiring a total gastrectomy.³⁵ Gastrojejunostomy was the other technique most used in our series, while in France, performing a more radical surgical procedure with lymph node dissection helps limit postoperative complications.³⁶ This difference is probably due to the fact that the cancer was discovered in our patients at an advanced age and stage, thus limiting more invasive management.

According to the data in the literature, abdominal pain is a frequent sign, usually occurring shortly after surgery, related to the operative wound and requiring analgesia in well-adapted doses.³⁷ Some of our patients presented with abdominal pain beyond the 6th postoperative day; this could therefore be explained either by the effect of the existing underlying complication, or by an inappropriate dosage of analgesics. In our series, we had a death rate of 40% (4 cases), this is in line with the data in the literature, especially according to Rawla et al who found that gastric cancer was the most common cause of cancer-related mortality globally up to the mid-1990s. Gastric cancer accounts for 783,000 deaths each year, making it the third most deadly cancer among males worldwide 8.3% of all cancer deaths are attributable to gastric cancer and in the Maghreb the prognosis is poor for patients treated for gastric cancer.^{31,38}

Limitations

During this study, we were stuck with problems such as the absence and/or insufficiency of key information for our study: patient history, clinical examination data, anatomopathological, biological and morphological examination results, and even surgical protocols.

CONCLUSION

The three surgical gastric pathologies found are perforation, stenosis and cancer of the stomach. If the first two affect a population of around 40 years, cancer is more present beyond 50 years. gastric perforation must be taken care of urgently because it is part of surgical emergencies (peritonitis) with a mortality rate of 15.8%. Gastric stenosis also requires rapid medical and surgical treatment, although postoperative complications are are. Cancer keeps a very high mortality much more because of the delay of consultation of the patients.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Raymon J, Nguyen VB, Vidal-Trecan G. Infection à *helicobacter pylori* chez l'enfant dans les pays en développement. *Med trop.* 2005;(65):383-5.
- Soreide K, Thorsen K, Harrison EM, Bingener J, Møller MH, Ohene-Yeboah M et al. Perforated peptic ulcer. *Lancet.* 2015;386(1000):128-98.
- Thorsen K, Søreide JA, Kvaløy JT, Glomsaker T, Søreide K. Epidemiology of perforated peptic ulcer: age- and gender-adjusted analysis of incidence and mortality. *World J Gastroenterol.* 2013;19(3):347-54.
- Gonzalez HA, Vaca GR, Del Vallin LS, Gutiérrez EA. Validation of diagnostic test. Value of hydrogastric ultrasound in the detection of gastric cancer. *Revista cubana de investigaciones biomédicas.* 2018;37(1):32-46.
- Blinder-Foucard F, Delafosse P, Remontet L, Woronoff A-S, Bossard N. Estimation nationale de l'incidence et de la mortalité par cancer en France entre 1980 et 2012. Partie I-tumeurs solides. synthèse. Saint Maurice (fra): institut de veille sanitaire. 2013;62(2):95-108.
- Zghari Z. sténose hypertrophique du pylore chez l'enfant. Thèse de médecine. faculté de médecine et de pharmacie de Rabat (Maroc). 2015.
- Assia B. Les ulcères gastro duodénaux et activité anti-hélico bacter pylori : aspect épidémiologique et phytothérapeutique traditionnel au Nord-Est de l'Algérie. Thèse de médecine Avril. 2018.
- CDU-HGE. abrégé d'hépatogastroentérologie et chirurgie digestive. 3rd éd. France: Elsevier Masson; 2015.
- Ali A, Omar T, Mayada T, Firas D, Sadok BJ, Wided B et al. Sténose ulcéreuse pyloro-duodénale. Thèse de médecine. Monastir (Tunisie). 2014
- Zitos C, Palta M, Willett CG, Halperin EG, Wazer DE, Perez CA. Stomach cancer. *Brady's principles and practice of radiation oncology.* 6th éd. 2013.
- Bah M, Traoré B, Boni JP, S Diane S, Keita M, Barry SM, et al. Aspects diagnostiques et thérapeutiques des cancers de l'estomac en milieu oncologique à Conakry. *Revue Afr de chirurgie et spécialités.* 2019;13(2):5-10.
- Nonga B, Tambo FF, Ngowe M, Takongmo S, Sosso MA. Etiologies des péritonites généralisées au CHU de Yaoundé (Cameroun). *Revue Afr de chirurgie et spécialités.* 2010;4(7):30-2.
- Ankouane F, Mathurin K, Nonga N. Histological types of gastric cancer and *helicobacter pylori* infection in Yaoundé (Cameroun). *J Cancer therapy.* 2015;6(08):701-8.
- Iler MH, Adamen S, Wojdeman M, Moller AM. Perforated peptic ulcer: how to improve outcome? *Scand J Gastroentérol.* 2009;44(1):15-22.
- Rabi A. Les péritonites par perforation d'ulcère gastrique ou duodéal chez l'adulte. Thèse de médecine n°21. Université de Mohamed VI. Maroc. 2016.
- Vignon KC, Mehinto DK, Vignon KR, Mbele RII, Natta N. Les perforations d'ulcère gastroduodéal au Centre National Hospitalier et Universitaire de Cotonou. *Eur Scientific J Benin.* 2016;12(27):117-28.
- Ouedraogo S, Zida M, Kambiré JL, Sanou A, Traoré S. Prise en charge des péritonites par perforation d'ulcères gastroduodénaux dans un hôpital secondaire Bourkinabè. *Science et technique. Sci de la santé.* 2016;(39):1-2.
- Manuel A, Wichendu PN, Enebeli VC. Presentation and management of perforated peptic ulcer disease in a tertiary centre in South-South Nigeria. *J West Afr College Surg Nigéria.* 2015;5(3):36-48.
- Cazejust J, Castaglioli B, Bessoud B, Rangheard AS, Rocher L, Menu Y. Gastroduodenal perforation: the role of MDCT. *J Radiol.* 2007;88(1):53-7.
- Guirat A, Abid M, Amar M, Ghorbel A, Mzali R, Frikha F, et al. Traitement laparoscopique des ulcères duodénaux perforés. *J I M Sfax.* 2007;13/14:22-6.
- Hamidi BE. Péritonite par perforation gastroduodénale. Thèse de médecine N°28. Maroc 2007.
- Kambiré J, Zaré C, Sanou B, Kambou T. Etiologies et pronostic des péritonites secondaires au centre hospitalier universitaire de Bobo Dioulasso. *J Afr d'HGE.* 2017;(11):149-51.
- Lopin G. Sténose du pylore, 2018. Available at : <https://cmpmu.fr/content/uploads/2018/10/Stenose-du-pylore-GLopin.pdf>. Accessed on 11 March 2021.
- Ndongo R, Tolefac PN, Tambo FFM, Abanda MH, Ngowe MN, Fola O, et al. Infantile hypertrophic pyloric stenosis: a 4-year experience from two tertiary care centres in Cameroon. *BMC Res Notes.* 2018 ; 11(1):33.
- Jia WQ, Tiam JH, Yang KH, Liu YL, Zhang P, Li RJ et al. Pylorotomie ouverte contre pylorotomie laparoscopique pour la sténose du pylore. *Eur J pediatr surg. Japon.* 2011;21(2):77-81.
- Oomen MW, Hoekstra LT, Bakx R, Ubbink DT, Heij HA. Open versus laparoscopic pyloromyotomy for hypertrophic pyloric stenosis: a systematic review and meta-analysis focusing on major complications. *Surgical Endoscopy.* 2012;26(8):2104-10.
- Chalya PL, Manyama M, Kayange NM. Infantile hypertrophic pyloric stenosis at a tertiary care hospital in Tanzania: a surgical experience with 102 patients over a 5-year period. *BMC Res Notes.* 2015;8:690.
- Binet A, Klipfel C, Meignan P, Bastard F, Cook AR, Braïk K et al. Laparoscopic pyloromyotomy for hypertrophic pyloric stenosis: a survey of 407 children. *Pediatr Surg Int.* 2018;34(4):421-6.
- Kassegne I, Sawa E, Kanasoua K, Alassani F. Prise en charge de la sténose pyloroduodénale péptique à

- l'hôpital universitaire Sylvanus Olympio de Lomé. *Med Santé Trop.* 2016;26(2):189-91.
30. Liu N, Molena D, Stem M, Blackford AL, Sewell DB, Lidor AO. Underutilization of Treatment for Regional Gastric Cancer Among the Elderly in the USA. *J Gastrointest Surg.* 2018;22(6):955-63.
 31. Mellouki I, Laazar N, Benyachou B, Aqodad N, Ibrahim A. Epidemiology of gastric cancer: experience of a Moroccan hospital. *Pan Afr Med J.* 2014;17:42.
 32. Rabai W, Makni A, Chébbi F, Baraket O, Fteriche F, Ayadi S et al. Clinicopathological features of gastric adenocarcinoma in young and elderly patients in Tunisia: a comparative study. *J Afr Hépatol Gastroentérol.* 2010;4:210-5.
 33. Nader FE. Prise en charge thérapeutique du cancer gastrique: expérience du centre d'oncologie hématologie chu Mohamed VI Marrakech. Thèse de doctorat N°185. Maroc. 2018.
 34. Toumi O, Hssine HB, Noomen F, Jabra SB, Korbi I, et al. Laparoscopic resection of gastric duplication in adults: successful treatment for a rare disease. *Pan Afr Med J.* 2015;22:145.
 35. Chevally M, Jung M, Morel P, Monig S. Cancer de l'estomac. Prise en charge et traitement multidisciplinaire. *Rev med Suisse.* 2018;(14):2221-5.
 36. Société française de Gastro-Entérologie. Le cancer de l'estomac. 2019. Available at: <https://www.snfge.org/content/2-cancer-de-lestomac>. Accessed on 10 March, 2021.
 37. El Rhrib M. Le cancer de l'estomac. Thèse de médecine. Faculté de médecine et de pharmacie de Marrakech (Maroc). 2007.
 38. Rawla P, Barsouk A. Epidemiology of gastric cancer: global trends, risk factors and prevention. *Prz Gastroenterol.* 2019;14(1):26-38.

Cite this article as: Engbang JP, Essola B, Ateba MR, Chasim CB, Massom GA, Ngowe MN. Surgical management and postoperative outcome of patients with gastric pathologies in three hospitals in the city of Douala. *Int Surg J* 2022;9:1167-73.