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Indication of Laparoscopy in Case of Tubal Infertility at the University Hospital of Brazzaville (Republic of Congo)

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Abstract: *Objective:* Analyze the determinants of the indication for laparoscopy in case of tubal obstruction on hysterosalpingography at the University Hospital Center of Brazzaville. *Methods:* Cross-sectional analytical study, conducted from January 1, 2015 to December 31, 2019, in the Obstetrics Gynecology Department of the University Hospital Center of Brazzaville, comparing 108 infertile patients with tubal obstruction to hysterosalpingography confirmed by methylene blue test (MBT-) in laparoscopy and 78 infertile patients with positive methylene blue test (MBT+) invalidating tubal obstruction in laparoscopy. Epi Info 7 software was used for statistical analysis. The p-value was considered significant for a p value < 5%. *Results:* Tubal obstruction was confirmed (MBT-) in 108 patients among the 186 selected for the study, i.e. 58.1%, and reversed (MBT+) in 78 patients, i.e. 41.9%. Tubal obstruction on laparoscopy was most observed in patients over 30 years old (84.3% vs 70.5%; OR=2.2 [1.1-4.6]; p<0.05), history of abortive endo-uterine maneuver (ORa=26 [17.9-38.9]; p<0.05), ectopic pregnancy (ORa=3.2 [1.4-52.1]; p<0.05), pelvic surgeries such as myomectomy (ORa=4.1 [1.2-18.4]; p<0.05), appendectomy (ORa=28.5 [1.5-54.7]; p<0.05) and salpingectomy (ORa=4.8 [2.3-12.5]; p<0.05) and suffering from chronic pelvic pain (ORa =4.1 [1.1-15.7]; p<0.03). The distal location of the tubal obstruction on HSG (ORa=2.8 [1.5-14.3]; p<0.05) and seropositivity for chlamydia trachomatis (ORa=41.2 [7.2 -234.8]; p<0.05) were most associated with negative MBT. *Conclusion:* The decision to perform a laparoscopy for tubal obstruction revealed by hysterosalpingography should take into account the determinants thus identified, especially when it comes to proximal tubal obstruction.

Keywords: Tubal Obstruction, Hysterosalpingography, Laparoscopy, Determinants, Brazzaville

1. Introduction

Tubal obstruction is a hindrance or obstacle to free access to the orifices and/or the lumen of the uterine tube [1]. According to the World Health Organization (WHO), it is one of the main causes of female infertility with a frequency of 12 to 40% in the West and 42 to 77% in Africa [2]. Consequently, tubal exploration occupies a prominent place in the assessment of female infertility and is based in first intention on the realization of a hysterosalpingography (HSG) [3]. Laparoscopy is recommended when the HSG shows tubal obstruction. However, the comparison of radiographic and laparoscopic results shows several discrepancies [4]. In the same department, Itoua reports

25.5% of false positives concerning tubal obstruction with HSG [5]. These findings thus call into question the systematic performance of laparoscopy in the event of tubal obstruction to HSG. In addition, proximal tubal obstructions do not offer therapeutic possibilities in laparoscopy.

Thus, to rationalize the indications for laparoscopy in female infertility, the present study aimed to analyze the determinants of the indication for laparoscopy in the event of tubal obstruction on hysterosalpingography after determining the predictive value positive hysterosalpingography in the diagnosis of tubal obstruction at the University Hospital Center of Brazzaville (UHC-B).

2. Methods

This was an analytical cross-sectional study, conducted from January 1, 2015 to December 31, 2019, in the Obstetrics Gynecology Department of the University Hospital Center of Brazzaville, including infertile patients who underwent laparoscopy for bilateral or unilateral tubal obstruction on single fallopian tube confirmed with HSG and divided into two groups according to the results of the Methylene Blue Test (MBT):

1) Group 1 "MBT negative": made up of patients in whom tubal obstruction was confirmed by laparoscopy.
2) Group 2 "MBT positive": made up of patients in whom the tubal obstruction was reversed by laparoscopy.

Were excluded in the two groups, the infertile patients having an HSG with abnormalities of the uterine cavity (synechia, intracavitary myoma), those who did not benefit from an MBT during the laparoscopy and those whose MBT was performed after a therapeutic procedure during laparoscopy.

Methylene Blue Test consisted of an injection under pressure, through the cervical canal, of a methylene blue dye diluted with physiological saline. The progression of the methylene blue solution in the fallopian tubes was marked by the taking of a bluish coloration of these.

Tubal patency was reflected by the spillage into the peritoneal cavity of methylene blue through the abdominal ostium of the fallopian tube.

Proximal tubal obstruction was confirmed whenever the progression of the injected methylene blue was stopped at the level of the interstitial or isthmic portion of the tube. It was said to be distal when the ampullary and/or pavilion portions were filled and distended with or without dilation, but without free spillage of methylene blue into the peritoneal cavity.

The variables studied were:

1) socio-demographic (age, marital status, sector of activity);
2) clinical (dysmenorrhea, chronic pelvic pain, dyspareunia, history of abdominal and/or pelvic surgery, duration of infertility, type of infertility, endometriosis, ectopic pregnancy, spontaneous miscarriage, induced miscarriage, uterine curettage);
3) paraclinical: biology (chlamydia serology), pelvic ultrasound (uterine myomas), HSG (type of obstruction), laparoscopy (type of obstruction, endometriosis).

Data analysis was performed using Epi-info 7 software. Quantitative variables with a normal distribution were expressed as a mean with their standard deviation and those with an eccentric distribution, expressed as a median with their quartile q1 and q3. The qualitative variables were presented as proportions expressed as a percentage. The positive predictive value of HSG was calculated. We used the chi-square test for the comparison of proportions; the Mann Whitney test for that of the medians. The significance threshold was set for a value of $p < 0.05$. In univariate analysis, the dependent variable was represented by the presence or absence of tubal obstruction on laparoscopy. This was crossed with the different independent variables. To establish the link and the degree of causality, the odds ratio (OR) was calculated with its 95% confidence interval. The significant link was determined by a 95% confidence interval not containing the number 1. In multivariate analysis, all variables with a value of $p<0.5$ were included in the logistic regression model in order to eliminate confounding factors.

3. Results

During the study period, 287 patients underwent laparoscopy, of which 201 or 70% were for tubal obstruction. One hundred and eighty-six or 92.5% were the subject of the study. Tubal obstruction was confirmed (MBT-) in 108 patients, i.e. 58.1%, and ruled out (MBT+) in 78 patients, i.e. 41.9% (table 1). The PPV in case of distal tubal obstruction was far superior to that in case of proximal obstruction predominated by false positive cases (table 1).

Table 1. *Positive predictive value of HSG by type of tubal obstruction.*

		Laparoscopy		
		MBT (-) (VP)	**MBT (+) (FP)**	**PPV [1] (%)**
HSG [2]	Proximal tubal obstruction	67 (48.2)	72 (51.8)	48.2
	Distal tubal obstruction	41 (87.2)	6 (12.8)	87.2
	Total	108 (58.1)	78 (41.9)	58.1

[1] Positive predictive value
[2] Hysterosalpingography

The patients were different in age. Tubal obstruction on laparoscopy was significantly associated with a history of uterine curettage, induced miscarriage and ectopic pregnancy (table 2).

Table 2. *Sociodemographic and reproductive characteristics.*

	MBT (-) N=108		MBT (+) N=78		*OR [CI (95%)]*	*p*
	n	**%**	**n**	**%**		
Age (years)					2.2 [1.1-4.6]	0.02
[19 – 30] *	17	15.7	23	29.5	-	-
[31 – 45]	91	84.3	55	70.5	-	-
Marital status						0.7
Married	66	61.1	46	59	-	-
Single	42	38.9	32	41	-	-
Reproductive characteristics						
Uterine curettage	86	79.6	8	10.3	34.2 [14.3-81.1]	0.001
Induced miscarriage	83	76.9	19	24.4	10.3 [5.2- 20.4]	0.001
Spontaneous miscarriage	24	22.2	15	19.2	-	0.6
Ectopic pregnancy	19	17.6	3	3.9	5.3 [1.5-18.7]	0.001

Patients with a history of gynecological pelvic surgery and those suffering from chronic pelvic pain had the most tubal obstruction on laparoscopy (Table 3).

Table 3. *Clinical characteristics.*

	MBT (-) N=108		MBT (+) N=78		*OR [CI (95%)]*	*P*
	n	**%**	**n**	**%**		
Functional signs						
Chronic pelvic pain	56	51.9	17	21.8	3.8 [2.0-7.4]	0.001
Dysmenorrhea	15	13.9	8	10.3	-	0.4
Dyspareunia	3	2.8	1	1.3	-	0.5
Surgical history						
Myomectomy	29	26.9	6	7.7	4.4 [1.7-11.2]	0.001
Appendectomy	25	23.2	1	1.3	23.2 [3.1-175.3]	0.001
Ovarian cystectomy	13	12.2	2	2.6	5.2 [1.1-23.7]	0.01
Salpingectomy	21	19.4	3	3.9	6 [1.7-21]	0.001
Caesarean section	7	6.5	4	5.1	-	0.4

The infertility profile had no influence on the occurrence of tubal obstruction (table 4). The type of HSG tubal obstruction and chlamydial serology influenced the results of MBT on laparoscopy (Table 4).

Table 4. *Paraclinical characteristics and infertility profile of patients.*

	MBT (-) N=108		MBT (+) N=78		*OR [CI (95%)]*	*p*
	n	**%**	**n**	**%**		
Site of tubal obstruction on hysterosalpingography					7.3 [2.9 – 18.4]	0.001
*Proximal obstruction**	67	62.1	72	92.3	-	-
Distal obstruction	41	37.9	6	7.7	-	-
Uterine myomas on pelvic ultrasound	14	12.9	12	15.4	-	0.6
Chlamydia serology					29.8 [12.5-71.3]	0.001
Positive	100	92.6	23	29.5	-	-
*Negative**	8	7.4	55	70.5	-	-
Type of infertility						0.05
Primary infertility	19	17.6	23	29.5	-	-
Secondary infertility	88	81.5	55	70.5	-	-
Duration of infertility (months)						0.5
[16 – 36]	26	24.1	22	28.2	-	-
[37 – 240[	82	75.9	56	71.8	-	-

*Reference

After logistic regression, the determinants of tubal obstruction at laparoscopy were in decreasing order: positive chlamydia serology, history of appendectomy, uterine curettage, salpingectomy, myomectomy, notion of chronic pelvic pain, history of ectopic pregnancy and distal location of HSG tubal obstruction (table 5).

Table 5. *Determinants of tubal obstruction at laparoscopy.*

	Univariate analysis		Multivariate analysis	
	OR [CI (95%)]	***p***	**ORa [CI (95%)]**	***p***
Age 31 - 45 years old	2.2 [1.1-4.6]	0.02	-	0.05
Chronic pelvic pain	3.8 [2.0-7.4]	0.001	4.1[1.1 – 15.7]	0.03
Appendectomy	23.2 [3.1-175.3]	0.001	28.5[1.5 – 54.7]	0.02

	Univariate analysis		Multivariate analysis	
	OR [CI (95%)]	***p***	**ORa [CI (95%)]**	***p***
Myomectomy	4.4 [1.7-11.2]	0.001	4.1 [1.2 – 18.4]	0.04
Ovarian cystectomy	5.2 [1.1-23.7]	0.02	-	0.6
Salpingectomy	6.0 [1.7-21]	0.001	4.8 [2.3 – 12.5]	0.01
Ectopic pregnancy	5.3 [1.5-18.7]	0.004	3.2 [1.4 – 52.1]	0.02
Induced miscarriage	10.3 [5.2- 20.4]	0.001	-	0.8
Uterine curettage	34.2 [14.3-81]	0.001	26 [17.9-38.9]	0.001
Distal Obstruction/HSG	7.3 [2.9 – 18.4)]	0.001	2.8 [1.5- 14.3]	0.02
Positive chlamydial serology	29.8 [12.5-71.3]	0.001	41.2 [7.2–234.8]	0.001

In the event of proximal tubal obstruction, five determinants have been identified, in decreasing order: positive chlamydial serology, history of uterine curettage, salpingectomy, ectopic pregnancy and secondary infertility (Table 6).

Table 6. *Determinants of proximal tubal obstruction at laparoscopy.*

	MBT (-)	MBT (+)	Univariate analysis		Multivariate analysis	
	n (%)	**n (%)**	**OR [CI (95%)]**	***p***	**ORa [CI (95%)]**	***p***
Age 31 - 45 years old	51 (77.3)	53 (70.5)	-	0.5	-	-
Chronic pelvic pain	36 (53.7)	16 (22.2)	4.1 [1.9-8.5]	0.00	-	0.2
Appendectomy	9 (13.6)	2 (2.7)	5.6 [1.2-26.9]	0.01	-	0.1
Myomectomy	15 (22.7)	4 (5.6)	4.0 [1.3-11.7]	0.00	-	0.1
Ovarian cystectomy	8 (11.9)	2 (2.8)	4.8 [1.1-23.6]	0.03	-	0.6
Salpingectomy	12 (17.9)	3 (4.2)	5 [1.4-19.3]	0.007	4.8 [2.3 – 12.5]	0.01
Ectopic pregnancy	11 (16.4)	3 (4.2)	4.7 [1.2-17.5]	0.01	3.2 [1.4 – 52.1]	0.02
Induced miscarriage	57 (85.1)	17 (23.6)	18.4 [7.7- 43.7]	0.001	-	0.2
Uterine curettage	58 (86.6)	8 (11.1)	51.5 [18.6-142]	0.001	26 [17.9-38.9]	0.001
Secondary infertility	58 (86.6)	53 (73.6)	2.3 [0.9 – 5.5]	0.05	2.8 [1.5- 14.3]	0.02
Positive chlamydial serology	60 (8.5)	19 (26.4)	23.9 [9.3-61.3]	0.001	36.1 [6.7–192.8]	0.001

In the case of distal tubal obstruction, the determinants were: positive chlamydial serology, history of appendectomy, myomectomy, chronic pelvic pain and history of uterine curettage (Table 7).

Table 7. *Determinants of distal tubal obstruction at laparoscopy.*

	MBT (-)	MBT (+)	Univariate analysis		Multivariate analysis	
	n (%)	**n (%)**	**OR [CI (95%)]**	***p***	**ORa [CI (95%)]**	***p***
Age 31 - 45 years old	37 (94.8)	5 (62.5)	11 [1.4-83.5]	0.001	-	0.05
Chronic pelvic pain	19 (48.7)	2 (25)	2.8 [1.1-15.9]	0.02	2.1 [1.1 – 15.7]	0.03
Appendectomy	9 (13.6)	2 (2.7)	5.6 [1.2-26.9]	0.01	7.3[2.5 – 20.9]	0.01
Myomectomy	13 (33.3)	2 (25.1)	-	0.2	2.3 [1.2 – 18.4]	0.02
Ovarian cystectomy	4 (10.5)	1 (12.5)	-	0.8	-	-
Salpingectomy	9 (23.1)	-	-	-	-	-
Ectopic pregnancy	9 (23.1)	-	-	-	-	-
Induced miscarriage	24 (61.5)	4 (50)	-	0.5	-	-
Uterine curettage	26 (66.7)	2 (7.1)	6.1 [1.1- 33.9]	0.02	2.1 [1.7-38.9]	004
Secondary infertility	29 (87.8)	4 (50)	-	0.1	-	0.2
Positive chlamydial serology	38 (97.4)	6 (75)	12.6 [1.1-162.2]	0.01	17.8 [2.2–144.1]	0.006

4. Discussion

Laparoscopy is the gold standard in the diagnosis of tubal obstruction [6]. The probability of tubal obstruction on laparoscopy when the HSG is normal remains very low [6].

The HSG remains the first-line examination in the exploration of tubal infertility [7-9]. Its positive predictive value was 58.1%, superimposable to that reported by Bosteels [10]. Taken separately, the probability of true tubal obstruction on laparoscopy when there is tubal obstruction on HSG was far greater in the case of distal location (87.2% vs 48.2%). Similarly, Medhi in Tunisia reports a strong laparo-hysterosalpingography discrepancy of 40% in the case of tubal obstruction proximal to HSG [11]. The low positive predictive value of HSG in the diagnosis of proximal tubal obstruction is reported in the literature and is probably related to functional obstructions [12]. Functional tubal obstructions are due to tubal spasm in response to pain and mucous plugging, corresponding to a reversible contraction of the utero-tubal junction [11]. There would be many other factors that would explain this laparo-hysterosalpingographic discrepancy and which would serve as indications for laparoscopy in the event of tubal obstruction with HSG.

Dreaded to be painful, HSG is an examination whose acceptability increases with the duration of infertility, partly explaining the advanced age of patients, most often in their thirties, as reported by many other authors [11, 13, 14]. Probably proportional to the duration of infertility and exposure to genital infections, age over 30 years was a confounding factor in our series, although initially doubling the risk of obstruction tu -baire as reported by some authors

[15]. Moreover, laparoscopy remains a surgical intervention, source of stress, not devoid of complications, not very available in our regions and having a high cost. As such, it is often neglected by some practitioners who prefer hydrotubation sessions, which can be a source of painful symptoms [12].

The functional signs reported by the patients were represented by chronic pelvic pain, dyspareunia and dysmenorrhea.

The presence of chronic pelvic pain quadrupled the risk of tubal obstruction. This is a frequent sign in women with tubal infertility [15], sometimes revealing inflammatory pathology of the pelvis, whether of infectious, endometriosis and/or adhesion origin [2]. Its association with tubal infertility has been reported by several authors and they would increase the risk of tubal obstruction by three to seven times, especially in the event of a history of pelvic surgery [15]. Indeed, pelvic surgery is a major factor in tubal obstruction with a variable risk threshold from one study to another [16, 17]. Its responsibility in the localization of the tubal obstruction depends on the type of surgery and the organ concerned. Highly adherent, myomectomy increased the risk of distal tubal obstruction twice as much, whereas proximal tubal obstruction was the most associated with salpingectomy.

Furthermore, the pelvic location of the appendix and the pelvic inflammation in the case of appendicitis have probably contributed by contiguity and/or peritoneal invasion to tubal involvement or pelvic adhesions, explaining the significant cases of tubal obstruction on more often distal. Also, appendectomy by laparotomy, as it is still practiced in our context, is a provider of pelvic adhesions which can thus be the cause of tubal obstruction [18]. In Luttjeboer's meta-analysis, a history of appendectomy increased the risk of tubal obstruction sevenfold [19]. Audebert reports that after pelvic surgery, 60 to 90% of patients develop adhesions [20]. Similarly, inflammation due to surgical aggression and postoperative infectious complications partly explain tubal involvement. Added to this are the changes in the tubo-ovarian relationships induced by the surgery [21]. All these different tubal impairments darken the obstetrical prognosis of the woman by exposing her to the risk of ectopic pregnancy.

In case of a history of tubal ectopic pregnancy, the tubal involvement is generally bilateral, which explains a high frequency of tubal obstruction on the contralateral fallopian tube [17]. In addition, surgery for tubal ectopic pregnancy, especially when performed in the open, can cause adhesions, which partly explains the frequent obstruction of the remaining tube [17]. The risk of tubal obstruction in our study was multiplied by three in the logistic regression model in women with a history of ectopic pregnancy.

Like the history of ectopic pregnancy, that of uterine curettage in an abortifacient context, frequently encountered in cases of secondary infertility, has been associated with an increased risk of tubal obstruction.

As for sexually transmitted infections, their role in the genesis of tubal infertility is well documented, the main incriminated germ being chlamydia trachomatis [15]. In our series, the risk of tubal obstruction was 41 times higher for patients seropositive for chlamydia trachomatis. Genital infection with chlamydia trachomatis remains the main cause of tubal infertility, particularly in Africa, incriminated in more than 70% of cases [2].

5. Conclusion

Tubal obstruction is the first indication for laparoscopy in gynecology at the University Hospital of Brazzaville. In nearly half of the cases, the tubes were found to be patent during laparoscopy. The positive predictive value of hysterosalpingography is higher when it comes to distal tubal obstruction. Tubal obstruction is more confirmed by laparoscopy in patients over the age of 30, suffering from chronic pelvic pain, in a context of chlamydia tracho-matis infection and a history of pelvic surgery and abortive uterine maneuver. The decision to perform a laparoscopy for tubal obstruction revealed by hysterosalpingography should take into account the determinants thus identified, especially when it is a proximal tubal obstruction.

Recommendations for Follow-up or Future Work on This Topic

It appears from our results that the indication of laparoscopy in case of tubal infertility should not be systematic. It imposes a rigorous selection of patients, considering their clinical profile and history of infertility.

Conflicts of Interest

All the authors do not have any possible conflicts of interest.

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