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TRANSUMBILICAL LAPAROSCOPIC ASSISTED APPENDECTOMY COMPARED WITH LAPAROSCOPIC AND LAPAROTOMIC APPROACHES IN ACUTE APPENDICITIS

Apendicectomia videoassistida por acesso único transumbilical comparada à via laparoscópica e laparotômica na apendicite aguda

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ABSTRACT – ***Background*** - Acute appendicitis is the most common cause of acute abdominal surgery. Despite nearly three decades comparing laparoscopic with laparotomic appendectomy, the available scientific evidence does not show consensus of opinion about the best access for the treatment of acute appendicitis. The transumbilical laparoscopic assisted appendectomy combines the advantages of laparoscopic access to the simplicity of the laparotomic technique. ***Aim*** – To compare the three technical advantages showing possible tendency to transumbilical laparoscopic assisted appendectomy. ***Methods*** - This is a retrospective study comparing three series with 1232 patients. Variables were: operative time, hospital stay, early and late postoperative complications, postoperative pain and earlier return to daily activities. ***Results*** - The averaged surgical time was 59.8 min in laparotomic appendectomy, 75.5 min in laparoscopic appendectomy and 51,7 min in transumbilical laparoscopic assisted appendectomy with significant difference. The incidence of postoperative pain, general complications and wound infection were greater in the group submitted to laparotomic appendectomy. The earlier return to daily activities and short hospital stay were observed in groups laparoscopic appendectomy and transumbilical laparoscopic assisted appendectomy. ***Conclusion*** - The effectiveness and safety of transumbilical laparoscopic assisted appendectomy can make this technique the preferred choice in the initial management of patients with acute appendicitis.

HEADINGS - Acute appendicitis. Appendectomy. Laparoscopy. Minimally invasive surgery.

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RESUMO – ***Racional*** - A apendicite aguda é a causa mais comum de abdome agudo cirúrgico. Apesar de quase três décadas de pesquisa, comparando a apendicectomia laparoscópica com a apendicectomia laparotômica, as evidências científicas disponíveis não mostram consenso de opinião a respeito da melhor via de acesso para o tratamento da apendicite aguda. A apendicectomia videoassistida por acesso único transumbilical visa combinar as vantagens do acesso laparoscópico com a simplicidade da técnica laparotômica. ***Objetivo*** - Comparar as três técnicas sinalisando as vantagens existentes no acesso único transumbilical. ***Métodos*** - Estudo retrospectivo, comparativo de três séries englobando 1232 pacientes. As variáveis analisadas foram: tempo operatório, permanência hospitalar, complicações pós-operatórias precoces e tardias, dor pós-operatória e retorno às atividades habituais. ***Resultados*** - Observou-se que os procedimentos acesso único transumbilical, apendicectomia laparoscópica e apendicectomia laparotômica apresentaram tempo de operação, em média, de 51,7 minutos, 75,5 minutos e 59,8 minutos, respectivamente, com diferença estatisticamente significativa. A incidência de dor pós-operatória, complicações gerais e infecção de ferida foram maiores no grupo apendicectomia laparotômica. Os grupos apendicectomia laparoscópica e acesso único transumbilical apresentaram retorno mais precoce às atividades habituais e menor permanência hospitalar. ***Conclusão*** - Atualmente não há condições de estabelecer-se entre as três técnicas a de padrão-ouro para o tratamento da apendicite aguda. A efetividade e a segurança da apendicectomia videoassistida por acesso único transumbilical, associadas aos atrativos da técnica, podem fazer dela a escolha preferencial na abordagem inicial dos pacientes com diagnóstico de apendicite aguda.

DESCRITORES - Apendicite aguda. Apendicectomia. Videolaparoscopia. Cirurgia minimamente invasiva.

INTRODUCTION

The acute appendicitis is the more common cause of acute surgery. Despite of almost two decades comparing laparoscopic with laparotomic appendectomy the scientific evidence available including prospective and randomized studies, meta-analyzes and reviews, there is no consensus opinion about the better via of treatment [6,8,26].

The video-assisted appendectomy through only transumbilical access has logical argument combining simplicity, speed and lower cost of laparotomy with the effectiveness, comfortable follow-up and lower morbidity of laparoscopy. Has good results in series involving adults and children[2,12,16,17]. In the context of uncertainty between which treatment is more effective in acute appendicitis due to few references in this issue on the literature, this original paper justifies its realization.

The objective of this study is to define the better access to be used in surgical treatment of initial phase of acute appendicitis.

METHOD

It is retrospective comparing three series, accomplished on Madre Teresa Hospital, Belo Horizonte, MG, Brazil. The project was approved by the Research Ethics Committee of the institution. Between January 2000 and December 2009, 1232 patients with suspect or confirmed diagnosis of acute appendicitis were submitted to appendectomy through video-assisted technique using only transumbilical access, laparotomy or laparoscopy. The patients were distributed in three groups: video-assisted appendectomy with 579 cases, laparoscopic appendectomy with 405 patients, and laparotomic appendectomy with 248 cases.

The laparotomic appendectomy was indicated in all SUS (Brazilian Federal Unified Health System) cases. The use of the other two techniques was based on equipment, instruments and optical availabilities and experience in video-assisted surgery of surgical team.

Patients with BMI> 30 Kg/m2 were classified as obese.

In appendectomy video-assisted technique pneumoperitoneum was installed after realization of a semicircular umbilical incision of 12 mm. One 5 mm operative optic device was introduced in one 11 mm umbilical trocar, and systematic exploration of abdominal cavity was done. The patient position was Trendelenburg with lateralization of 30 ° to the left. The appendix was fixed by its end with a laparoscopic forceps, and pulled out with its meso; at this moment, evaluation of the mobility to bring it out through the trocar was done. The resection of appendix and meso was realized with outside progressive conventional ligature and occlusion of its base using nonabsorbable polyester 2.0 thread. The cecum was reinstated into abdominal cavity and a new insufflation was done to evaluate the integrity of cecum, the length of the appendicular stump, review of hemostasis and aspiration of eventual content in cavity.

In laparoscopic technique were used two alternatives. On method with the optical device included operative channel were used two portals - umbilical and suprapubic -, and in classical technique additional incision of 5 mm in left iliac fossa was done. Was carried out the appendix skeletonization and hemostatic local control, including the appendicular artery by monopolar electrocoagulation and, sometimes, adding metal clips. The appendicular base was treated with extracorporeal knot of polyglactin 0 (Roeder way).

In laparotomic access was used the incision type Babcok and in peritoneal diffuse irritation or inflammatory appendicular mass the operation was done through a median infra-umbilical incision.

The collected data were registered in specific protocol on Excel ®. The following variables were analyzed: operative time, postoperative pain, early and late complications, hospital stay and return to usual activities. It was considered as postoperative pain the need of opioids and/or intravenous analgesia from of second day, postoperatively.

The results on type of operation were obtained initially by descriptive analysis using frequencies and percentages. The univariate analysis and quantitative characteristics were done with test F (ANOVA) when the assumption of normality was satisfied and Kruskal-Wallis, on the contrary. At the comparisons two and two categories was utilized the test of Mann-Whitney. The comparisons between the binary variables t-student was used. The categorical characteristics were compared with other categorical placed on tables of contingency and applied the chi-square test with correction of Yates. In case of more than two categories was utilized the test of Pearson. In frequency less than five, the test exact of Fisher was used. In multivariate analysis were developed models of logistic regression in agreement with the feature of variable response.

RESULTS

Analyzing the data (1232 patients), in laparotomic appendectomy the age average was of 35.8 years; in laparoscopic, 32.2; and on video-

assisted, 29.2 years.

The three techniques were employed to the treatment of acute appendicitis both of complicated form (37.9% in laparotomy, 19.7% in laparoscopy and 18.3% in video-assisted) as at the not complicated (58.9% in laparotomy, 74.6% in laparoscopy and 77.5% in video-assisted).

In relationship to the BMI, it was observed that laparotomy was used more frequently that the laparoscopic or the video-assisted approach in obese patients (laparotomy in 10.5%, laparoscopy in 6.7%, and video-assisted in 4.6%) or overweight (laparotomy in 18.5%, laparoscopy in 15.3%, and video-assisted in 15.6%).

The female predominated at laparoscopy (61%) and video-assisted (68.7%), and the laparotomy was more often maid in men (66.5%).

The Table 1 has the description of operative time by technique employed. It is observed that the patients that were submitted to procedures type laparotomy, laparoscopy and transumbilical video-assisted had time of operation in average of 60 minutes, 76 minutes and 52 minutes, respectively.

Patients submitted to laparoscopic appendectomy had operative time greater compared to other groups, and in cases done through laparotomy the duration of procedure was superior to the video-assisted.

On laparotomized patients, the chance of pain was about four times greater than in the ones submitted to laparoscopy (33.9% in laparotomy and 8.9% in laparoscopy; p< 0.001). No significant difference was obtained comparing video-assisted and laparoscopic approach (11.9% in video-assisted and 8.9% in laparoscopic). The statistical model to assess the incidence of complications in relationship to type of operation it is presented in Table 2.

It was observed that patients submitted to laparotomic appendectomy presented

TABLE 1 – Description of operative time by type of procedure

Feature	n	Average	DP	Minimum	1ºQ	Median	3ºQ	Maximum	P-value
Time of operation									
Laparotomic appendectomy	248	59,8	18,9	30,0	45,0	55,0	65,0	180,0	<0,0011
Laparoscopic appendectomy	405	75,5	22,7	30,0	60,0	70,0	90,0	155,0	
Transumbilical video-assisted appendectomy	579	51,7	17,8	20,0	40,0	50,0	60,0	150,5	

Note: 1= Test of Kruskal-Wallis; p-value = Level of significance

TABLE 2 – Model of logistic regression - complications

Model	Coefficient	Standard error	p	OR	95%	
					Inferior	Superior
Constant	-2,3	0,2	<0,001	1,7		
Type of operation						
Laparotomic appendectomy	0,5	0,2	0,033	0,8	1,04	2,7
Video-assisted transumbilical appendectomy	-0,2	0,2	0,427	1,0	0,5	1,3

TABLE 4 – Comparisons between hospital stay and type of operation

Features	Stay hospital			p
	Average	DP	Median	
Laparotomic appendectomy	2,9	1,9	3,0	<0,001[1]
Video-assisted transumbilical appendectomy	2,1	1,4	1,5	
Laparoscopic appendectomy	2,2	1,4	2,0	

Note: 1 = Kruskal-Wallis test

TABLE 3 – Comparison of type of operation in relationship the complications

Features		Type of operation						p
		Laparotomic		Laparoscopic		Video-assisted		
		n	%	n	%	n	%	
Wound infection	Yes	17	6,9	11	2,7	14	2,4	0,004[1]
	No	231	93,1	394	97,3	565	97,6	
Intra-abdominal abscess	Yes	4	1,62	8	2,0	5	0,9	0,286[2]
	No	244	98,4	397	98,0	574	99,1	
Incisional hernia	Yes	8	3,2	0	0,0	2	0,4	0,055[2]
	No	240	96,8	405	100,0	577	99,6	
Intestinal obstruction	Yes	1	0,4	0	0,0	0	0,0	0,201[2]
	No	247	99,6	405	100,0	579	100,0	
Seroma	Yes	13	5,2	19	4,7	23	4,0	0,695[1]
	No	235	94,8	386	95,3	556	96,0	

Notes: 1 = Test of Pearson; 2 = test exact of Fisher

approximately two times the possibility of being evolved with complications in relationship to those submitted to video-assisted (p=0.033).

The Table 3 has the comparisons of complications in relationship to types of operation. Was observed association between the type of procedure and wound infection p=0.004), and significance tendency in relationship to incisional hernia (p=0.055).

In relationship to wound infection, from 248 patients submitted to laparotomy 17 (6.9%) had it; of 405 patients addressed to laparoscopy, 11 (2.7%) were affected; of 579 cases of video-assisted, 14 (2.4%) infected the wound.

Interpreting the descriptive statistics of hospital stay by type of operation, the patients submitted to laparotomy remained three days hospitalized and by video-assisted two (p<0.001).

Laparotomic appendectomy had in average 12 hours more in hospital stay than laparoscopy (IC95%: 0,3 to 0,7). No difference was observed among those submitted to appendectomy video-assisted in relationship to laparoscopy (p=0.562) (Table 4).

In relationship to the time of return to activities, difference with significance statistics was reached at the comparisons between laparotomy and video-assisted and between laparotomy and laparoscopy. Return to activities after eight days was 33.5% in laparotomy and 17.5% in video-assisted. After 14 days, 9.7% in laparotomic and 4.9% in laparoscopy. These percentages indicate that video-assisted and laparoscopy returned precociously to activities (seven days). No difference on time to return to activities was observed between laparoscopy and video-assisted (74.8% and 76.3%).

The Table 5 shows the conversion in relationship to type of operation. From 42 patients submitted to laparoscopy, in 24 (57.1%) was used Babcok laparotomy and in 18 (42.9%) median incision. In relationship to 69 patients that were submitted to video-assisted requiring conversion, 12 (17.4%) were submitted to laparoscopy, 16 (23.2%) in video-assisted with two accesses, 26 (37.7%) to Babcok laparotomy and 15 (21.7%) to median laparotomy.

The Table 6 has the conversions in relationship to type of operation and cause of conversion.

TABLE 6 – Type of operation in relationship to cause of conversion

Technique	Causes of conversion	Type of operation			
		Video-assisted		Laparoscopic	
		n	%	n	%
Global		69	100,0	42	100,0
	Bleeding	8	11,8	3	7,1
	Dense inflammatory adhesions	23	33,8	21	50,0
	Retrocecal appendix	3	2,9	0	0,0
	Retroileal appendix	0	0,0	2	4,8
	Subserosal appendix	4	5,9	1	2,4
	Necrotic pre-perfurative appendix	16	23,5	0	0,0
	Perforated appendix	11	16,2	13	30,9
	Diffuse peritonitis	3	4,4	0	0,0
	Cecal laceration	1	1,5	1	2,4
	Thermal ileal lesion	0	0,0	1	2,4

DISCUSSION

The laparotomic appendectomy, by more than a century, was considered secure and effective treatment to acute infections due its safety, simplicity, speed and mortality next of zero. Although its effectiveness, this via maintains morbidity not negligible, varying between 10% and 20%[9].

On 80´s the laparoscopic technique was incorporated to therapeutic armory of acute appendicitis. The advantages in relationship to laparotomy were: reduction of postoperative pain, lesser hospital stay, fast return to activities, minor global cost, better aesthetic result, allowance

TABLE 5 – Technique of conversion in relationship to type of operation

Feature	Type of operation						p
	Laparotomic		Laparoscopic		Video-assisted		
	n	%	n	%	n	%	
Total of procedures	248	100,0	405	100,0	579	100,0	
Total of conversions							
Yes	0	0,0	42	10,4	69	13,6	0,522[1]
No	0	0,0	363	89,6	510	86,4	
Technique							
Laparoscopic appendectomy	0	0,0	0	0,0	12	17,4	
Video-assisted with two access	0	0,0	0	0,0	16	23,2	
Total of laparotomic appendectomy	0	0,0	42	-	41	-	
Babcok laparotomic	0	0,0	24	57,1	26	37,7	0,719[1]
Median laparotomic	0	0,0	18	42,9	15	21,7	

Notes: 1 = Test chi-square with correction of Yates

of total abdominal cavity exploration and more appropriate intra-cavity cleaning. The identification of appendix can be done with magnification of image[11,15,18].

However, the laparoscopic appendectomy demand longer surgical time and has higher operative costs. Is technically more laborious, when compared to laparotomy[13,26]. Sometimes have proper complications as visceral thermal lesions, vascular trauma or visceral perforation by the trocar[8].

In of context of uncertainty between which treatment is more effective and due to its attractive potential, the video-assisted approach was introduced in teenagers and adults[2,12,16,17,21].

Based on the literature[2,12,14,19,21,28] the method video-assisted provides some attractives, namely: explore all the abdominal cavity providing accurate diagnosis, permits complete and effective cleaning; requires only a laparoscopy diagnostic to locate and externalize the appendix with magnification of image; no need of special materials; no raising in costs; ease to be use in urgency and at night; can be covered by health system in Brazil. Externalized, the appendix can be removed like in laparotomy, with its safety, easy execution, speed and low cost. Method less invasive with only an umbilical small incision. It provides excellent aesthetic result.

Confronting with the other series of appendectomy video-assisted with transumbilical access, the average surgical time was lesser (25 min to 35 min[17]) excluding complicated forms of acute appendicitis. Meyer et al.[16] in 163 cases of appendectomy video-assisted by access only transumbilical, reported duration of procedure of 29 minutes with incidence of complicated forms in 2.8%.

Two papers that compared the three techniques, using two or three access in video-assisted approach, also showed surgical time lesser on method video-assisted in relationship to laparotomic and to laparoscopic[19,28].

In video-assisted, the principal surgical moment is accomplished out of abdominal cavity and this detail contributes to reduce the time of the procedure.

There is significant decrease in the amount of analgesics administered on first day[6]. The video-assisted favors less time of exposure to pneumoperitoneum and requires lower pressure when compared to laparoscopy. This fact contributes to decrease the pain due to irritation and distension of the diaphragm. This possibility did not find support on results of the present study. The diaphragmatic irritation can be associated more to the Trendelenburg position than to time of exposure to pneumoperitoneum.

The number of small incisions in laparoscopic appendectomy in relationship to only one portal in video-assited also not influenced in occurrence of pain, postoperatively. Blinman[3] showed that the laparotomic incision causes more tension and pain when compared to combination of small incisions. File et al.[12], in 300 patients submitted to video-assisted, reported 6.6% of postoperative complications and no deaths[4].Konstadoulakis et al.[10] compared the video-assisted with two portals with the laparoscopic appendectomy with similar morbidity, 10% and 10.8% respectively. Observed that the patients submitted to laparotomic appendectomy presented approximately the double of risk of develop complications, in relationship to other techniques.

On present study, statistic significant difference happened between laparotomic appendectomy and the other less invasive approaches. In laparoscopic appendectomy there is more wall protection because the appendix is withdrawn off through trocar or wrapped avoiding direct contact with the wound.

Incisional hernia was diagnosed in eight cases post laparotomic appendectomy (3.2%) and in two submitted to video-assisted (0.4%) and in none in laparoscopy.

Some studies suggest that the incidence of intra-abdominal postoperative abscess is more frequent after laparoscopic appendectomy compared with the open technique when both are performed by complicated appendicitis[8,23]. Other publications showed that the risks of intra-abdominal complications, including abscesses, are similar between the laparoscopic and laparotomic approaches[1,5]. Strickland and Martindale[23] reviewed the literature with the goal of identify potential causes to explain the increase of incidence of intra-abdominal infection after laparoscopic procedures. They refer direct effects of pneumoperitoneum on the systems of peritoneal defense. The incidence of intra-abdominal abscess in this series, did not present statistic association comparing the techniques.

In this study, the cases of laparotomic appendectomy had hospital postponed in 12 hours in relationship to laparoscopic group.

The video-assisted appendectomy incorporating the principles of minimally invasive surgery provides shorter period of hospital stay, as in laparoscopy. This benefit permits less trauma, less pain and quicker mobilization.

In this research, there was no differences on time to return to activities and schoolwork between the patients submitted to video-assisted and laparoscopic procedures. In many series, the precocious return to activities usually was confirmed as advantage inherent to laparoscopic technique in relationship to laparotomy. This

assertive is important to decrease the global cost of treatment of acute appendicitis.

On laparoscopic group 42 patients (10.4%) were converted to laparotomy. The video-assisted appendectomy was completed in 510 (86.4%) patients. There were 69 conversions (13.6%). In literature conversion to laparotomic procedure ranged from 1.4% to 7.6%. The need of additional trocar ranged between 3.7% to 11.4%[16,17,21]. In pediatric patients the rate of conversion was between 0.3% and 8%[25].

The commitment of surgeon should be always with the patient and not with the technique. The difficulty or uncertainty in operation is enough to render to the necessity to conversion. Recognizing the limit of minimally invasive surgery shows maturity and experience. Is wise to avoid situations that undertake insecurity and promotes unacceptable extension of surgical time[12,22,24] .

This research, based on original initiative, expressive number of patients and results, tries to stimulate the realization of other analytical studies. They are fundamental to determine the treatment gold-standard in acute appendicitis.

CONCLUSION

The effectiveness and safety of transumbilical laparoscopic assisted appendectomy can make this technique the preferred choice in the initial management of patients with acute appendicitis.

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