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Research Article

Lymph Node Resection in Colon Adenocarcinoma. Quality Procedure Revision in an Academic Center

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Abstract

The presence of lymph node metastases are one of the more important prognoses factors in colon cancer, along with the presence of hepatic metastases and the depth of colon wall invasion by the tumor. We present an observational descriptive prospective study, considering patients who were assisted in the Hospital Pasteur between 1/08/05 and 6/08/09, which went under Colectomy by adenocarcinoma.

Results: We registered 132 colonic resections by cancer in this period, eliminating 14 patients, being n = 118. In 93 a satisfactory lymphadenectomy was made (SL), which represented a 79%, 81.8% in minors of 65 years and 78.8% in greater. (p ns). In men, SL = 47 cases (75.8%), and in women SL = 46 (82%) (p ns).

In right Colectomy LS = 84.4%, left and transverse colon 89.3% and sigmoid colon 68.8% (p = 0,04).

In coordination surgery, SL was 81.5%, in Urgency 72.3% (p ns). For T1 tumors a satisfactory lymphadenectomy was made in 1 of 4 cases (25%), T2 in 4 of 5 (80%), T3 in 34 of 46 (73.9%) and T4 in 54 of 63 (85.7%) (p ns).

Conclusion: In our hospital almost 80% of lymph node resections in colon cancer surgeries were considered satisfactory, with 21% of non-satisfactory resections (NSL). The variables like age, sex, surgery opportunity, degree of wall invasion and the pathologist did not determine statistically significant differences in the correct lymph node resection.

Keywords: *Lymph Node Resection; Colon; Cancer; Colectomy*

Introduction

Importance of the subject: Colon cancer is one of the most common tumors in western world, and one of the first causes of death by cancer [1,2]. In the U.S.A. the colon cancer occupies the first places in frequency, being the third more frequent tumor and the second cause of death by cancer, with an incidence of 100 thousand new cases in 2007 [1,2]. In Uruguay the colorectal cancer constitutes a serious sanitary problem, being ours one of the countries with greater incidence and mortality by colorectal cancer. It constitutes the second cause of death by cancer in the women and third in the men [3].

In 95% of cases, adenocarcinomas have different differentiation degrees, being the good differentiated 20%, moderately differentiated 60% and badly differentiated a 20% from the total [2]. Surgery is the only therapeutic tool that has demonstrated to offer a real chance of healing, being the best palliative option too [1,2].

The presence of lymph node metastases is one of the most important prognoses factors, along with the presence of liver metastases and the depth of wall organ invasion, as it was postulated by Dukes in 1932, and as it is presented/displayed by the UICC in their classification TNM [1,4-11].

It has been fully proved more than 20 years ago that the presence or absence of lymph node metastases have a great impact in survival rate and free disease rate, conditioning the indication of an adjuvant therapy [1,2,4-14].

The importance of adjuvant chemotherapy in those patients with lymph node metastases has already been demonstrated, determining an improvement in survival and free time of disease rates [4-8,18,38]. Lymph node invasion is a very important fact in those patients without remote metastatic dissemination, in whom a supposedly curative therapy is considered.

Known it is that 50 - 60% of patients at the moment of diagnose present lymph node invasion [22].

Multiple reports show almost 25% of early local and/or general tumor recurrence in patients that the presence of lymph node metastases were discarded by the pathologist (that is patient N0) [1,4,7,10,16].

This means in other words, that there must exist false N0 in total of patients. False N0 can be explained because the number of lymph node resected is insufficient, leading to an incorrect staging.

An insufficient lymph node resection can be explained by several factors: 1) bad surgical technique, 2) tumor Biology, tumor location or wall invasion degree, 3) patient characteristics, or 4) existence of previous mesial resections or radiation, as it happens in neoadjuvant therapy for rectal cancer.

On the other hand, a sufficient lymph node resection can be wrongly considered insufficient due to an incorrect work of the pathologist, who does not make a correct node search.

Bad surgical technique and incorrect lymph node dissection by the pathologist are variables that can be corrected with the purpose of diminishing the tumor sub staging, that takes to inadequate treatments.

A correct surgical technique depends as well on several factors, like surgeon´s training and the number of patients operated by center [11]; tumor location, patient age, the tumor like stage and the clinical presentation (cancers that makes debut like a complication) are elements that also influence in the lymphadenectomy.

Coloproctologists obtain better surgical pieces, with greater number of lymph nodes [10,11,27-29].

It's known that in right and subtotal colectomy a greater number of lymphatic nodes are obtained, whereas transverse and left colectomy, and low rectal resection are associated with a minor number of node resections [4-6,31-34]. This is explained partly because in right colectomy, surgical pieces are of greater size than in left ones, with greater number of lymph node stations [1].

It has also been demonstrated that the number of lymphatic nodes analyzed is related to the pT of classification TNM. There are works that show a greater number of ganglia obtained in the T4 tumors [10,35]. Other works demonstrated in addition that the number of node resection was greater in stage III tumors that in stage I and II, with an average of 11 ganglia for stages III, 10 for stages II and 6 for stage I [10,12,30,32].

Patient age can modify node resection; with a reduction of 6.8% by each 10 years of age increase [1,10,26,35].

According to some authors this can be explained because surgeons make smaller resections in patients of greater surgical risk (greater of 65 years).

Obesity has also been related to a significant diminution of the number of resected nodes in colorectal surgery [1,36].

In palliative surgery, as well as in urgency surgery, fewer nodes are obtained. This can be explained because the pieces that are obtained are smaller than in programmed surgeries [1,36,37].

Nowadays a minimum of 12 nodes is accepted to consider a lymph node resection like suitable, since the ganglionary resection by itself is considered an independent prognosis factor [1,2,4-8,10]. This data is of such importance that becomes a tool to audit surgeons and pathologists work.

The pathologist meticulous lymph node search is of vital importance following this aim, since it allows a correct staging of the disease. At this moment the standard technique for the obtaining of ganglia is the classic manual technique, with hematoxylin eosin staining. It is a tedious technique and is based on visual identification or palpation of the ganglia, for its later dissection and individualization. It is a difficult technique that requires time and dedication. Like it happens with surgical results, the volume of patients assisted by hospital, laboratory characteristics and interest and training of the pathologist conditions the study of the piece [38-51].

Objectives

- The primary objective of our work was to analyze the incidence of satisfactory lymph node resection in patients with resective colon cancer surgeries.
- As a secondary target, we analyzed the different variables that can influence in the quality of the lymph node resection.

Place of Application

Coloproctology Department of Surgical Clinic "1", Hospital Pasteur, Montevideo, Uruguay.

Design

This is an observational descriptive prospective study.

Population

We considered patients who were assisted at the Hospital, either by the Surgical Clinic "1" (elective surgery) or by Emergency Service (urgency surgery), where a resective colon cancer surgery was made, in the period between the 1/08/05 to 6/08/09.

The exclusion criterion included the absence of patronymic data, absence of anatomopathological report, as well as all the surgeries in which resective procedures were not made. We also excluded rectum cancer patients.

Materials and Methods

A registry data list in agreement with the pathologist was made, considering all anatomopathological reports. The following data was consigned: piece's macro and microscopy, number of ganglia colonized by cancer and presence of micro metastases, as well as lymph node conglomerates.

In addition an Excel list was made in which the following variables were briefed: patronymic data, age, sex, tumor-like topography, complications, procedure, metastases presence, number of lymph node resected, positive and negative ganglia for cancer, pathological anatomy, pieces preparer and staging according to pre-and post- operating TNM.

For cancer diagnosis, anatomopathology information was taken into account; the resective pieces were studied by pathologists of the department of pathological anatomy of the Hospital Pasteur.

We divided surgical procedures in urgency and elective ones.

For age, we considered two groups, older than 65 years and younger of this age, based on similar studies about the subject.

For topography three groups were considered: 1. Right colon tumors, including the caecum, ascending and of the hepatic flexure tumors. 2. Left colon and transverse tumors, and finally 3. Sigmoid cancers.

For depth of bowel wall invasion, TNM classification of the UICC was used.

For lymph node resection we considered two groups: 1. Patients with resections greater than 12 nodes, and those with dissections smaller to this number (11 or less), basing the arbitrary election of this value on data collected of previous international studies about the subject. Two technicians we identified like preparer 1 and 2 made the preparations of the anatomopathological pieces.

For the statistical analysis, the different continuous variables were expressed like mean and its standard deviation; in order to compare proportions with nominal variables, the test of x2 was made. We considered a value of $P < 0,05$ statistically significant.

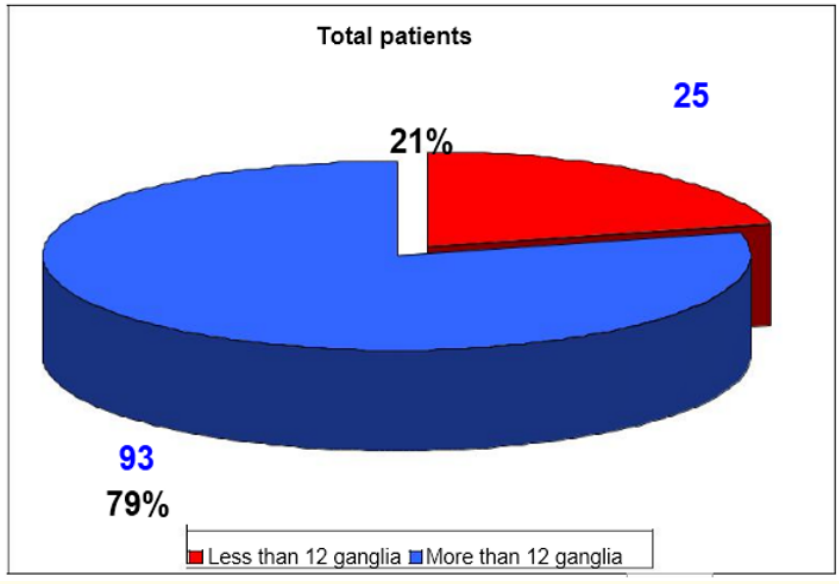
For data analysis we use SPSS version 15.0.

Results

In the period were registered 132 colon resections; we eliminated by the aforesaid criteria 14 patients, resulting in a total of 118 patients.

Of that total of 118 patients, in 93 cases a satisfactory lymph node resection was made (greater than 12 nodes), which represented a 79%. In the 25 remaining cases the node resection was smaller than 12 (11 or less), representing a 21%.

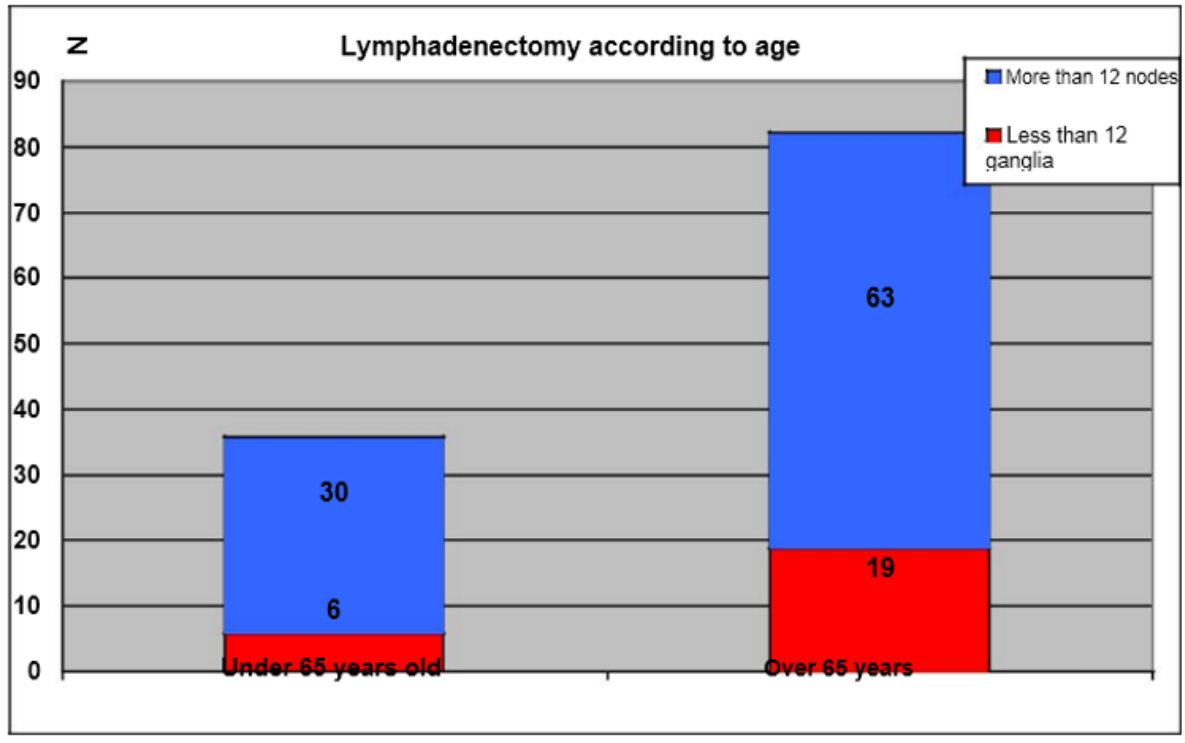
	Less than 12 nodes	More than 12 nodes
Total patients	25 (21%)	93 (79%)



Graph 1: *Studied patients.*

Age analysis: in the under 65 years group we found 36 patients; in 30 cases the resection was adequate (30/36 or 83.3%), meanwhile in the remaining 6 cases we found less than 12 nodes (6/36 or 16.7%). In those older than 65 years we found 82 patients, of which 63 had a lymphadenectomy of 12 or more (63/82 or 76.8%) and 19 cases did not reach this value (19/82 or 23.2%).

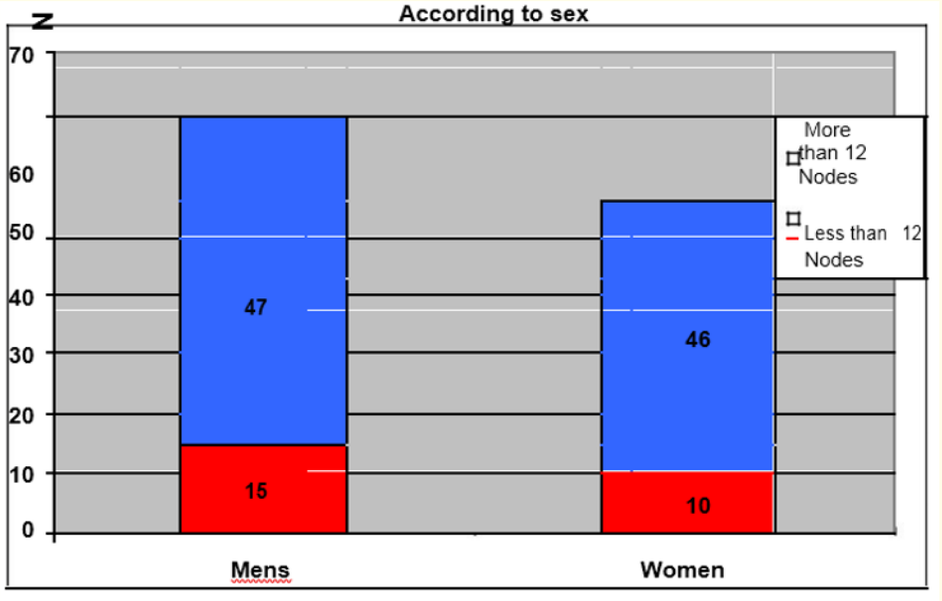
Of the total of unsatisfactory dissections (taking the total n = 25 as 100%), 76% (n = 19) corresponded to patients older than 65 years; while 24% (n = 6) were performed in minors of this age. These data were not statistically significant.



Graph 2: *Lymph node resection according to age.*

	Less than 12 nodes	12 or more nodes	NSL percentage
Total N	25	93	21%
Under 65 years	6	30	16,7%
Over 65 years	19	63	23,2%

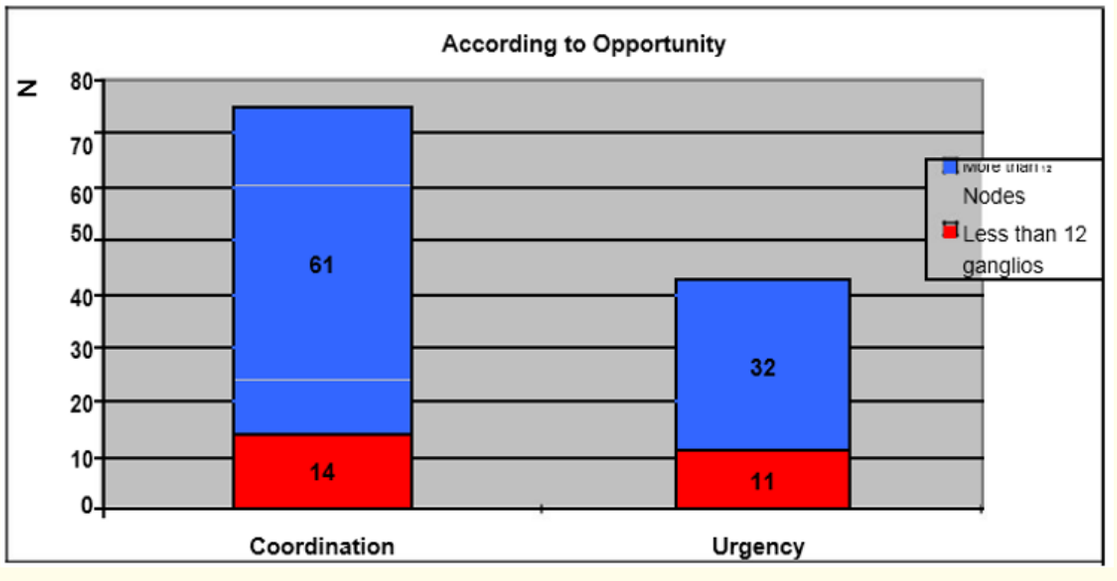
Sex: 62 men and 56 women were considered. In men, lymphadenectomy was satisfactory in 47 cases (75.8%), while in women it was satisfactory in 46 cases (82%). Thus, of the total unsatisfactory lymphadenectomies (n = 25 as 100%), men represented 60% (n = 15) and women 40% (n = 10). Statistically non-significant data.



Graph 3: *Lymphadenectomy according to Sex.*

	Less than 12 nodes	More than 12 nodes	NSL percentage
Total N	25	93	21%
Male	15	47	24,2%
Female	10	46	17,9%

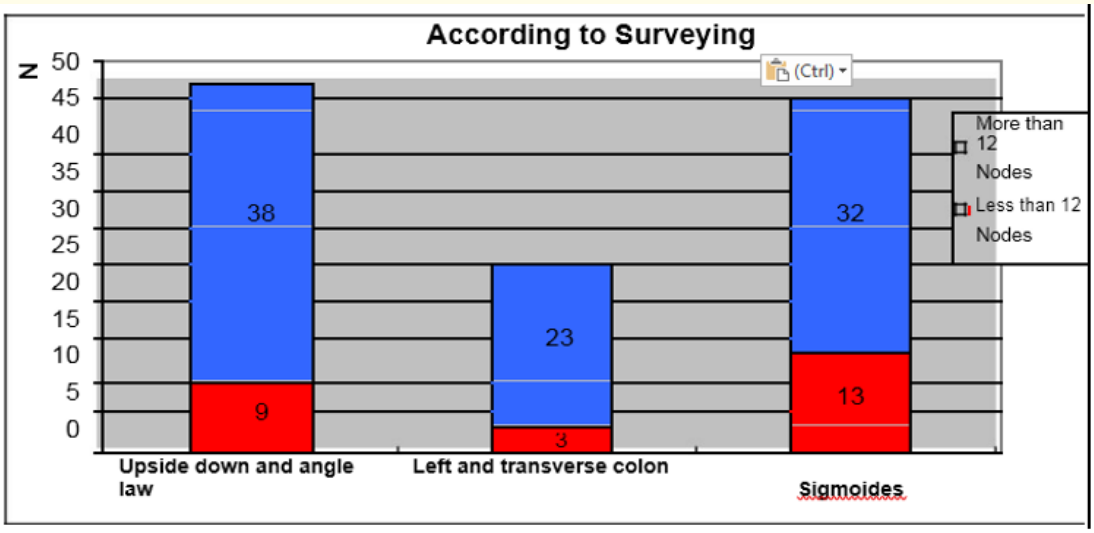
Elective and urgency procedures: we found 61 satisfactory lymphadenectomies of 75 elective surgeries (81.3%), and 32 of 43 (74.4%) of Urgency procedures. The percentages of unsatisfactory lymphadenectomies were then 18.7% for elective and 25.6% for urgency. Statistically non-significant data.



Graph 4: *Lymphadenectomy according to the elective and urgency surgery.*

	Less than 12 nodes	More than 12 nodes	NSL percentage
Total N	25	93	21%
Elective	14	61	18,7%
Urgency	11	32	25,6%

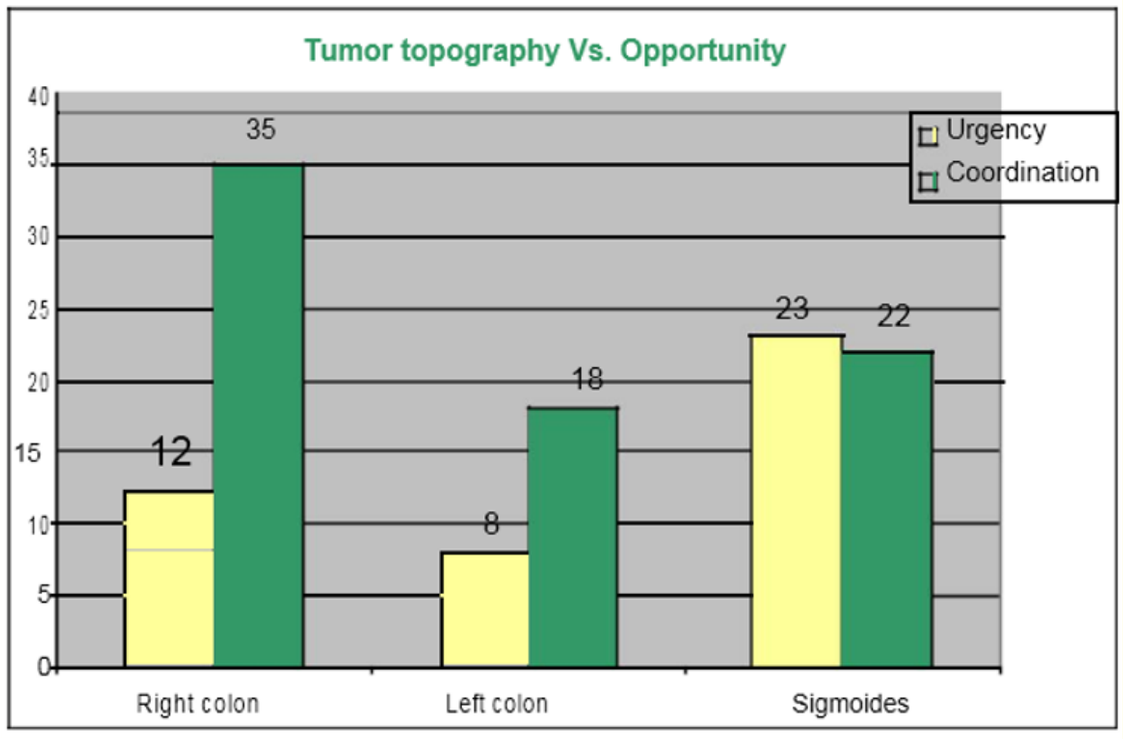
Topography: In right colon resections, a satisfactory lymphadenectomy was performed in 38 of 47 cases (80.9%), in left and transverse colon in 23 of 26 cases (88.5%) and in sigmoid colon in 32 of 45 cases (71.1%). The percentages of unsatisfactory lymphadenectomies were 19.1%, 11.5% and 28.9% respectively. In this case there were statistically significant differences between the sigmoid colon and the other topographies.



Graph 5: *Lymphadenectomy according to tumor topography.*

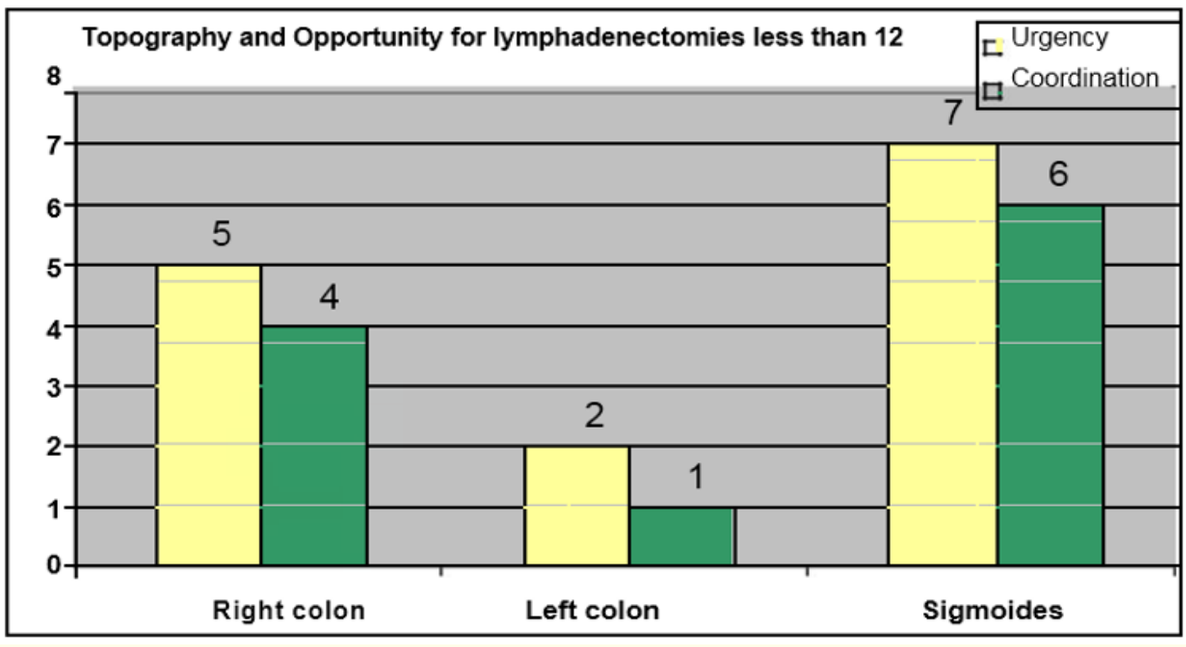
	Less than 12 nodes	More than 12 nodes	NSL percentage
Total n	25	93	21%
Caecum, ascending and hepatic flexure colon	9	38	19,1%
Left and transverse colon	3	23	11,5%
Sigmoid colon	13	32	28,9%

Then we cross elective end non-elective surgery with tumor topography, first considering all patients and then only those with insufficient lymphadenectomies. We noted that the number of unsatisfactory lymphadenectomies was similar for urgency and elective procedures.



Graph 6: *Tumor topography vs. elective/non-elective surgery in total number of patients.*

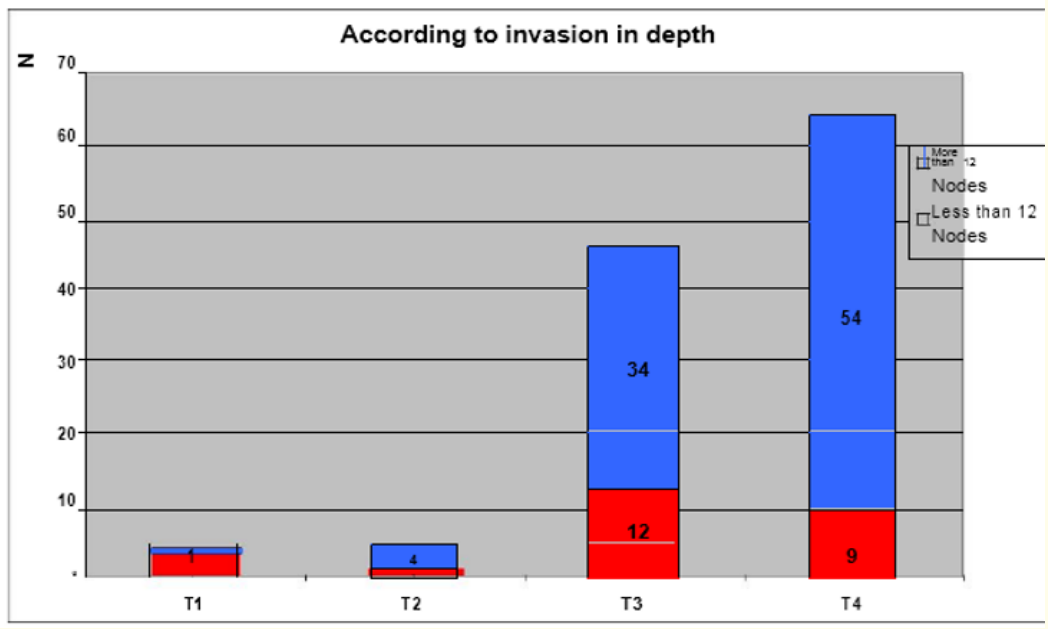
	Urgency	Elective
Right colon	12	35
Left colon	8	18
Sigmoid colon	23	22



Graph 7: *Topography and elective/non-elective surgery in patients with Lymphadenectomies Under 12.*

	Urgency (non-elective)	Elective
Total N	14 (56%)	11 (44%)
Right colon	5 (10,6%)	4 (8,5%)
Left colon	2 (7,7%)	1 (3,8%)
Sigmoid colon	7 (15,6%)	6 (13,3%)

Degree of bowel wall invasion: For T1 tumors a satisfactory lymphadenectomy was performed in 1 of 4 cases (25%), for T2 in 4 of 5 (80%), for T3 in 34 of 46 (73.9%), and for T4 54 of 63 (85.7%). Statistically non-significant data.



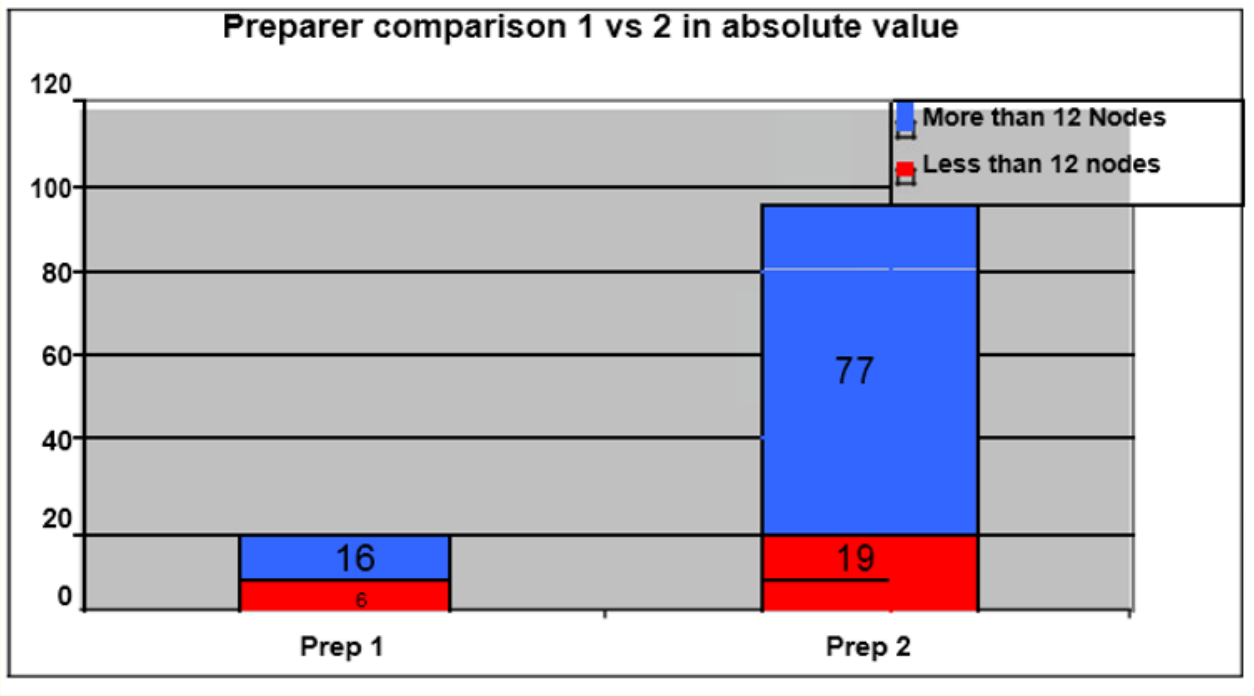
Graph 8: *Lymphadenectomy according to Degree bowel wall invasion (T).*

	Less than 12 nodes	12 or more nodes	Total	NSL percentage
T1	3	1	4	75%
T2	1	4	5	20%
T3	12	34	46	26%
T4	9	54	63	14,3%
Total N	25	93	118	21%

Preparer (Technician)

Preparer 1 carried out the study of 22 pieces, finding more than 12 lymph nodes in 16 of these (72.7%) and less than 12 in 6 (27.3%).

Preparer 2 studied 96 pieces, finding more than 12 lymph nodes in 77 of these (80.2%) and less in 19 (19.8%). No statistically significant differences were obtained when both preparers were compared.



Graph 9

	Less than 1 nodes	More than 12 nodes
Prep 1	6 (27,3%)	16 (72,7%)
Prep 2	19 (19,8%)	77 (80,2%)
	25	93

Discussion

First of all, and responding to our primary objective, a satisfactory lymph node resection was made in 79% of cases in resective surgery by colon cancer (93 of 118 patients). Lymph node resection was lower than 12 nodes in the rest of the patients (21%). This relation is revealed like an index of satisfactory quality, not only of surgical technique but also of pathologists work. We based this affirmation on international literature. It is so Trufelli [52] finds in an analysis of 106 patients, a 42.5% of the registries with less than 10 ganglia.

Chen [53], in a meta-analysis that studies relation between extension of lymph node resection and survival rate, only finds 38% of patients with 11 or more resected nodes. Spanish association of surgeons work on quality control in colon surgery [54] indicates that the average number of resected nodes is 10,7. Our mean is 16 nodes.

Analyzing variables that can influence in node resection we see that age greater to 65 years could be an inferior quality of lymph node resection determining factor, since in this age group a 76.8% satisfactory lymph node resection was made, against 83.3% in minors of 65 years. International reports speak of fall in lymph node resection quality with patients age increase. According to some authors, this would be explained by less extensive resections made by surgeons in patients higher surgical risk, in order to diminish operating time [13].

The population we analyzed was in 69,5% of cases of 65 or more years, so this variable is of greater importance. Nevertheless of the analysis, these differences were not statistically significant in our series of patients.

Analysing gender, lymph node resection seems to be better in women, with 82% of satisfactory resections against 75.8% in men. This variable was again not statistically significant. This fact is in agreement with the analyzed international bibliography, in which gender seems not to influence in node resection quality.

The following variable to consider is surgery's opportunity, were we found 74.4% of satisfactory urgency node resection, against 81.3% in elective surgery, data that is also coincident with international series. This can be explained by local conditions (inflammatory processes, mesial retraction, bad bowel preparation) as well as patient conditions that generate technical difficulties and demand greater speed in acute problems resolution, sacrificing oncological radicality. Nevertheless, it was not statistically significant.

Bibliography affirms that lymph node resections for right and subtotal colectomies are of better quality than in left and sigmoid colectomies. This fact seems to be caused by greater anatomical pieces and a greater amount of lymphatic stations for these resections. In our series we found statistically significant differences in sigmoidectomies, where we clearly obtained a smaller percentage of satisfactory lymph node resections, and right and left colectomies group (transverse colon + left flexure + descendent).

In case that lymph node worst quality resection was caused by a greater amount of emergency resections, we studied relation between tumor location and elective/non-elective surgery. We saw that the number of sigmoid urgent surgeries was almost the same as elective ones. This fact shows that sigmoid resection is an independent variable that can affect lymph node resection quality.

When we analyzed only those non-satisfactory lymph node resections, we saw that in all tumor topographies emergency/urgency procedures predominated. This shows the influence of surgery opportunity in lymph node resection quality.

According to bowel wall invasion degree ("T"), results obtained again are in agreement with bibliographical data, obtaining best satisfactory resections in T4 tumors (85.7%) against 73.9% in T3, 80% in T2 and only 25% in T1. This phenomenon could be explained because, with greater tumor sizes comes greater presence of visible lymph nodes, which could explain a more complete node resection and a better node identification by the pathologist.

Nevertheless, as in some of the variables previously analyzed, not statistically significant differences were found.

In preparers (pathologist technicians), a difference between nodes found by preparer 1 and 2 existed, having found preparer 2 more than 12 nodes a greater number of times than preparer 1 (80.2% against 72.7%). These data in our series were not statistically significant.

This can be explained by the numerical differences of both groups that determine that they are not comparable of the statistical point of view.

This variable is of extreme importance since with surgical technique, are considered the most important factors for improvement results in colon cancer treatment. In the same way they are considered a quality standard for specialized colon cancer treatment centers [1,55].

Conclusions

As a conclusion we can say in the first place that in our Centre, a satisfactory lymph node resection in colon cancer surgeries was made in almost 80% of patients, according to international Literature.

We have also seen that age, elective /non-elective surgery and degree of bowel wall invasion, factors that usually influence lymph node resection quality, did not show to affect the correct node resection in our series. Nevertheless there was in our series a tendency of the

absolute values of these variables that agrees with international bibliography results. We obtained better results in patients younger than 65 years, elective surgeries as well as in T4 tumors. Possibly the lack of statistically significant results in these variables was due to a small number of patients.

Sex did not show statistically significant differences, which agrees with international bibliography data.

We found in sigmoid colon worst indices of satisfactory lymph node resections than in other tumor locations. This was significant of the statistical point of view and coincident with international literature.

Sigmoid resection was an independent variable in our series in obtaining similar non-satisfactory lymph node resection numbers in urgency and in elective surgery.

We did not find statistically significant differences in lymph node quality resection between the 2 studied preparers. We can attribute this fact to the numerical disparity of pieces analyzed by the trainers.

Declaration of Conflicts of Interests

The authors declare that conflicts of interest in the present work do not exist.

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