Laparoscopic Cholecystectomy and Open Cholecystectomy in Acute Cholecystitis: Critical Analysis of 520 Cases

Colecistectomia por Laparoscopia e por Laparotomia na Colecistite Aguda: Análise Crítica de 520 Casos

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Acta Med Port 2014 Nov-Dec;27(6):685-691

ABSTRACT

Introduction: Despite the skepticism with which it was initially seen, laparoscopic cholecystectomy is now the technique of choice for acute cholecystitis. It is, however, important to evaluate the results in comparison with classic cholecystectomy, since the latter is still used by some surgeons in certain situations.

Material and Methods: Our research corresponds to the analysis of 520 patients operated on for acute cholecystitis performed in the department of surgery at the São João Hospital in Oporto - 412 (79.2%) laparoscopic cholecystectomies and 108 (20.8%) open cholecystectomies - from 2007 to 2013. We evaluated comorbidities, leukocytosis, time between diagnosis and surgery, ASA, per and postoperative complications, mortality, reoperations, lesion of main bile duct, conversion rate and hospital stay, in order to compare these two techniques. The conversion group was included in laparoscopic cholecystectomy. Statistical analysis was based on descriptive statistic procedures and the evaluation of contrast between groups was based on Fishers' exact test. Significant values were considered for $p < 0.05$.

Results: Laparoscopic Cholecystectomy versus Open Cholecystectomy: Mortality: 0.7% *vs* 3,7% ($p = 0.0369$); Peroperative complications: 3.6% *vs* 12.9% ($p = 0.0006$); Surgical postoperative complications: 7.7% *vs* 17.5% ($p = 0.0055$); Medical postoperative complications: 4.3% *vs* 5.5% ($p = 0.6077$); Lesion of the main bile duct: 0.9% *vs* 1.8% ($p = 0.6091$); Reoperation: 2.9% *vs* 5.5% ($p = 0.2315$); Hospital stay up to 4 days after surgery: 64.8% *vs* 18.5% ($p < 0.001$). The convertion rate was of 10.7%: 8.8% in early surgery (before 4 days after de diagnosis) and 13.7% in the late surgery (after this time but in the same stay) ($p = 0.1425$). Multiple causes led to convertion: surgical complications (biliary lesions, iatrogenic lesion of the small bowel, perfurations of the gallbladder with spillage of stones); complications during the pneumoperitoneum, unclear anatomy and scoliosis. Postoperative complications in laparoscopic cholecystectomies converted group *vs* non-converted: surgical 20.4% *vs* 6.2% ($p = 0.0034$) and medical 6.8% *vs* 4.1% ($p = 0.4484$).

Discussion: There are few investigations concerning the comparison of laparoscopic cholecystectomy *vs* acute cholecystitis in patients with acute cholecystitis, corresponding mostly to multicenter studies. For this reason, we carry out an analysis inherent to 520 patients operated on with that disease in the surgery department of Hospital S. João in Oporto of which 412 were by laparoscopic cholecystectomy and 108 by acute cholecystitis. We found better results in laparoscopic cholecystectomy than in acute cholecystitis with respect to mortality, per and post-operative surgical complications and hospital stay. The incidence of main bile duct injury, medical complications and reoperations, although less evident in laparoscopic cholecystectomy, were not statistically significant. There were more complications in the group of laparoscopic cholecystectomy converted than in those where it was not be necessary the conversion. This raises the need, in complications during the laparoscopic cholecystectomy, not to perform the conversion too late. The analysis of this study, therefore, properly values laparoscopic cholecystectomy in the surgery of patients with acute cholecystitis.

Conclusion: The results justify the frequency with which laparoscopic cholecystectomy is performed in acute cholecystitis, in comparison to open surgery, thus taking an increasingly prominent place in the treatment of this disease.

Keywords: Cholecystectomy, Laparoscopic; Cholecystectomy; Cholecystitis.

RESUMO

Introdução: Apesar do cepticismo com que inicialmente foi encarada, a colecistectomia laparoscópica é hoje a técnica de eleição na colecistite aguda. Torna-se, porém, importante avaliar os seus resultados, em comparação com a colecistectomia clássica, uma vez que esta última ainda é seguida por alguns cirurgiões em determinadas situações.

Material e Métodos: No nosso estudo foram incluídos 520 doentes com colecistites agudas operados no Serviço de Cirurgia Geral do Hospital de S. João, entre 2007 e 2013, dos quais 412 (79,2%) por laparoscopia e 108 (20,8%) por via aberta, com uma incidência de conversão de 10,7%. Procedeu-se ao estudo relativo às doenças coexistentes, leucocitose, tempo decorrido entre o diagnóstico na urgência e a cirurgia, classificação ASA, complicações intra e pós-operatórias, mortalidade, reintervenções, lesão biliar e estadia hospitalar. Os doentes convertidos foram incluídos no grupo das colecistectomias laparoscópicas. A análise estatística baseou-se em processos descritivos e a avaliação das diferenças entre grupos foi realizada com base no teste exato de Fisher, sendo considerados valores significativos para $p < 0,05$.

Resultados: Colecistectomia laparoscópica *versus* Colecistectomia aberta: Mortalidade: 0,7% *vs* 3,7% ($p = 0,0369$); Complicações per-operatórias: 3,6% *vs* 12,9% ($p = 0,0006$); Complicações pós-operatórias cirúrgicas: 7,7% *vs* 17,5% ($p = 0,0055$); Pós-operatórias médicas: 4,3% *vs* 5,5% ($p = 0,6077$); Lesão da via biliar principal: 0,9% *vs* 1,8% ($p = 0,6091$); Reintervenções: 2,9% *vs* 5,5% ($p = 0,2315$); Internamento hospitalar inferior ou igual a quatro dias: 64,8% *vs* 18,5% ($p < 0,0001$). Na colecistectomia laparoscópica houve 10,7% de conversões: nas precoces (intervenções realizadas antes das 96 h após o diagnóstico na urgência) esta taxa foi de 8,8% e nas tardias (após aquele período de tempo mas no mesmo internamento) de 13,7% ($p = 0,1425$); Complicações nos doentes convertidos *vs* não convertidos: nas cirúrgicas 20,4% *vs* 6,2% ($p = 0,0034$) e nas médicas 6,8% *vs* 4,1% ($p = 0,4484$). As causas de conversão

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Recebido: 12 de Fevereiro de 2014 - Aceite: 02 de Outubro de 2014

foram condicionadas por complicações cirúrgicas (lesões biliares, lacerações entéricas, perfurações vesiculares com a disseminação de cálculos), intolerância ao pneumoperitoneo, indefinição do pedículo biliar e escoliose.

Discussão: Há poucas investigações relativas à comparação da colecistectomia laparoscópica *vs* colecistectomia aberta nos doentes com colecistectomia aberta, correspondendo a maior parte delas a estudos multicêntricos. Por esta razão, julgamos de interesse proceder a uma análise inerente a 520 operados com aquela doença no Serviço de Cirurgia Geral do Hospital de S. João dos quais 412 por colecistectomia laparoscópica e 108 por colecistectomia aberta. Verificamos na colecistectomia laparoscópica melhores resultados do que na colecistectomia aberta no que se refere à mortalidade, complicações per e pós-operatórias cirúrgicas e estadia hospitalar. A incidência da via biliar principal, complicações médicas e reintervenções, embora menos evidentes na colecistectomia laparoscópica, não se revelaram com significado estatístico. Merece referência o maior número de complicações no grupo das colecistectomias laparoscópicas convertidas do que naquelas em que tal não foi necessário confirmando-se, assim, o já referido em estudos multicêntricos citados na literatura. Este facto levanta a necessidade de, mediante complicações ocorridas durante a colecistectomia laparoscópica, não se proceder à conversão tardiamente. A análise do presente estudo valoriza, assim, devidamente a colecistectomia laparoscópica na cirurgia dos doentes com colecistite aguda.

Conclusão: Os resultados obtidos justificam a frequência com que a colecistectomia laparoscópica é realizada na colecistite aguda, em comparação com a via aberta, ocupando cada vez mais, um lugar primordial, no tratamento desta doença.

Palavras-chave: Colecistectomia Laparoscópica; Colecistectomia; Colecistite.

INTRODUCTION

The laparoscopic approach was initially considered contraindicated for surgical treatment of acute cholecystitis.[1] Since the mid-nineties, it became the main technique for this disease.[2,3] However, some authors still use open cholecystectomy in certain circumstances.[4]

MATERIAL AND METHODS

From January 2007 to October 2013, 520 patients with acute cholecystitis were operated in the Surgical Department at the Hospital de S. João do Porto, having been admitted through the Emergency Department.

In total, 412 (79.2%) laparoscopic (LC) and 108 (20.8%) open cholecystectomy (OC) procedures were performed. Cholecystotomy procedures were excluded from our study. The option between each type of surgery was made according to the surgeon's experience in minimally-invasive surgery, the presence of severe systemic changes or biliary peritonitis; this last group of patients was included in the open cholecystectomy group. The group of converted patients was included in the group of laparoscopic cholecystectomy patients.

Diagnosis was based on clinical, laboratory and imaging (ultrasound) data. Histological confirmation was obtained in all the patients.

Surgery was performed upon failure of adequate medical therapy.

Sixteen patients presented in shock comprising 11 LC (2.6%) and five OC (4.6%) patients; the haemodynamic changes presented by these patients were corrected prior to surgery; jaundice was observed in 16 LC (3.8%) and in seven OC (6.4%) patients, related to the presence of bile duct calculi. Common bile duct (CBD) calculi were diagnosed during the ultrasound examination in 23 patients who were transferred from A&E Department to the Surgical Department: endoscopic removal was performed in 16 patients, three to four days before LC and CBD stone removal was undertaken during OC in the remaining seven patients.

Patient's average age (± standard deviation) by surgery type was 55.24 years (± 16.8) in LC and 70.55 years (± 14.7) in OC patients.

The surgical techniques were described in a previous manuscript.[5]

The statistical analysis was based on descriptive procedures, the differences between the groups were evaluated based on Fisher's exact test and significant values were considered for $p < 0.05$.

RESULTS

The number of patients who underwent laparoscopic (LC) and open cholecystectomy (OC) are presented according to gender, co-morbidities, presence of leucocytosis, timeframe between diagnosis at A&E and surgery, American Society of Anaesthesiologists (ASA) classification, intra and postoperative complications, mortality, re-interventions, presence of gallbladder lesions and hospital stay.

Gender: Male: 204 (49.5%) LC and 46 (42.5%) OC patients; $p = 0.2340$; Female: 208 (50.4%) LC and 62 (57.4%) OC patients; $p = 0.2340$.

Leucocytosis above 12,000,000/ml^3: 267 (64.8%) LC and 89 (82.4%) OC patients, $p = 0.0004$.

Timeframe between diagnosis at A&E and surgery (on the same admission):

LC: Four days or below: 250 (60.6%), above four days: 162 (39.3%), $p < 0.001$;

OC: Four days or below: 84 (77.7%), above four days: 24 (22.2%) $p < 0.001$.

ASA III and IV: 85 LC patients were included in these groups (20.6%) and 40 (37.0%) OL patients; $p = 0.0006$ (Table 1).

Intraoperative complications: these occurred in 15 LC (3.6%) and 14 OC (12.9%) patients (p =0.0006). The complications related to conversions were included in the LC group of patients (Table 2).

CBD lesions (two in LC and one in OC patients) occurred in three patients and six patients presented with cystic duct lesions (three LC patients – two during the dissection of a cholecysto-duodenal fistula, with severe inflammatory signs and the remaining patient related to the removal of a large calculus from a scleroatrophic gallbladder – and three OC patients). These occurred during the cholecystocystic dissection aimed to carry out a peri-operative cholangiography. Haemorrhagic complications occurred in six patients, three due to a lesion of the cystic artery (two

Table 1 - Comorbidities

Comorbidities			
	LC	OC	*p*
Diabetes	57 (13.8%)	25 (23.1%)	0.0253
Cardiovascular disease	117 (28.3%)	49 (45.3%)	0.011
Chronic obstructive pulmonary disease	21 (5.1%)	6 (5.6%)	0.8097
Chronic kidney failure	17 (4.1%)	10 (9.2%)	0.0478

Table 2 - Peri-operative complications

Peri-operative complications	*p* = 0.0006	
	LC (15)	OC (14)
CBD lesion	2	1
Haemorrhagic complications	4	2
Lesion to the cystic duct	3	3
Gallbladder perforation	5	6
Small bowel iatrogenic lesion	1	2

LC and one OC patient) and three during the gallbladder dissection from the liver bed (two LC and one OC patient). Gallbladder perforation always occurred in patients with gangrenous cholecystitis with high abdominal dissemination of calculi. Iatrogenic small bowel lesion occurred in one LC patient, following a trocar placement to obtain the necessary pneumoperitoneum. Two OC patients suffered intestinal lesions during the dissection of cholecysto-duodenal fistulae.

Postoperative complications:

Surgical: in 32 LC (7.7%) and 19 OC (17.5%) patients; *p* = 0.0055 (Table 3)

Biliary fistulae occurred in 15 patients: three patients presented CBD lesions (two LC and one OC patient), intra-abdominal bile collection (biloma) occurred in nine patients (five LC and four OC), cystic duct dehiscence occurred in two patients and one dehiscence of a hepaticojejunostomy in a converted LC due to CBD lesion (this patient died). The three cases of CBD lesion were corrected with a biliary-digestive anastomosis. Bilomas were corrected by ultrasound-assisted percutaneous drainage in six patients (three LC and three OC patients) and during ERCP in the remaining three patients (two LC and one OC). Eighteen patients presented with an abdominal abscess (13 LC and five OC patients); surgical re-intervention was only necessary in two LC patients and the remaining were

Table 3 - Surgical post-operative complications

Post-operative complications: Surgical	*p* = 0.0055	
	LC (32)	OC (19)
Abdominal abscess	13 (2 *)	5
Abdominal wall infection	6 (5 *)	2
Eventration	0	3
Haemoperitoneum	2	2
Diabetic foot amputation	1	0
Biliary fistulae:	10 (2 *)	5
- CBD lesions	2	1
- Cystic dehiscence	2	- - -
- Dehiscence of the hepatojejunal anastomosis	1 (**)	- - -
- Biloma	5	4
Colic perforation	0	1
Occlusion	0	1

(*) surgical conversion; (**) CBD lesion in converted LC.

corrected with ultrasound-assisted percutaneous drainage. Four patients presented with haemorrhagic problems, two LC patients (following iatrogenic splenic lesion and following liver laceration) and two OC patients (lesion of the cystic duct). Diabetic foot amputation was necessary in one patient presenting with postoperative sepsis. As referred above, the patients who underwent converted LC were included in these complications.

Medical: twenty-four patients presented with medical postoperative complications: 18 LC patients (4.4%) and six (5.5%) OC patients (p = 0.607) (Table 4).

Most complications occurred in patients aged above 70 (12 LC and five OC patients). One patient presented with multi-organic failure following cardiovascular and kidney complications.

Operative mortality: Seven patients died (three LC (0.7%) and four OC (3.7%) patients; p = 0.0369). Causes of death in LC patients included stroke, peritonitis with septic shock and CBD lesion and in OC patients included septic shock following an abdominal abscess with respiratory complications, iatrogenic lesion to the colon, multi-organic failure (with severe kidney failure), gallbladder haemorrhagic lesion in a patient with peri-operatively corrected CBD lesion. Five from these seven patients presented with gangrenous cholecystitis (three LC and two OC patients).

CBD lesion: Six patients presented with CBD lesions, four LC (0.9%) and two OC patients (1.8%) (p = 0.6091); three of these patients were peri-operatively diagnosed (two LC and one OC) and three at the immediate postoperative stage (two LC and one OC); all these patients were included in Bismuth's classification group II; two followed lateral CBD lesions and four followed CBD cross-section lesions; treatment included termino-terminal anastomosis (one LC and one OC patient) and hepaticojejunostomy (two LC and two OC patients).

Conversions: In total, 44 conversions were performed (10.7%). An 8.8% conversion percentage was found on the first four days upon diagnosis (reached in A&E) and 13.7% thereafter during the same admission (p = 0.1425).

Conversions followed gangrenous cholecystitis (10 patients), with dissemination of calculi, undefined biliary pedicle (27 patients – two cholecystoduodenal fistulae), CBD lesions (two patients), cystic duct lesions (two patients), small bowel iatrogenic lesion (one patient), scoliosis (one patient) and pneumoperitoneum intolerance (one patient). Gender-related incidence was 8.8% (male) and 12.5% (female) (p = 0.2661). Regarding patient's age, 16.5% was the rate in patients aged above 65 and 7.6% in younger groups (p = 0.106). The following complication rates were found in converted *vs.* non-converted patients: surgical 20.4% *vs.* 6.2% (p = 0.0034) and medical complications 6.8% *vs.* 4.1% (p = 0.4484).

Table 4 - Medical post-operative complications

Post-operative complications: Medical p **= 0.6077**		
	LC (18)	**OC (6)**
Respiratory	9 (3 *)	2
Renal	4	1
Cardiovascular	3 (1 **)	1
Pulmonary embolism	1 (***)	0
Cellulitis of the lower limb	1	0
Hypoglycemia	0	1
Paralytic ileus	0	1

(*) surgical conversion; (**) stroke-related; (***) related to respiratory complications.

Table 5 - Re-interventions

Re-interventions p **= 0.2315**		
	CL (12)	**CA (6)**
Haemoperitoneum	3	1
Biliary fistula	3	0
CBD lesions	2	1
Removal of drainage interiorized into the abdomen	1	0
Removal of foreign body	1	0
Eventration and Evisceration	0	3
Abdominal abscess	2	0
Iatrogenic perforation of the colon	0	1

Table 6 - Overall analysis

	LC		OC		
	n	%	*n*	%	*p - value*
Intra-operative complications	15	3.6	14	12.9	0.0006**
Post-operative complications: global	50	12.1	25	23.1	0.0055**
Post-operative complications: surgical	32	7.7	19	17.5	0.0055**
Post-operative complications: medical	18	4.3	6	5.5	0.6077
Re-interventions	12	2.9	6	5.5	0.2315
CBD lesion	4	0.9	2	1.8	0.6091
Mortality	3	0.7	4	3.7	0.0369*
Hospital stay < 4 days	267	64.8	20	18.5	< 0.0001**

** $p < 0.01$; * $p < 0.05$.

Re-interventions: In total, 12 (2.9%) were performed in LC and six (5.5%) in OC patients ($p = 0.2315$) (Table 5), including eight laparotomy procedures (seven LC and one OC patient), one splenectomy (LC), three corrections of abdominal wall dehiscences (three OC patients), three biliary-digestive system anastomoses (two LC patients and one OC patient) and one colostomy. Removal of postoperative drainage interiorized into the abdomen, removal of a foreign body and one abscess were operated through laparoscopic procedure. The converted LC patient with a hepatojejunal dehiscence due to peri-operative CBD lesion in whom it was only possible to perform a biliary drainage was included in the seven LC patients who underwent laparotomy procedures.

Hospital stay: In total, 171 LC (41.5%) and in 20 OC patients (18.5%) ($p < 0.001$) had a four-day or shorter hospital stay.

DISCUSSION

Laparoscopic Cholecystectomy, which was initially considered contraindicated in patients with acute cholecystitis, gradually became the gold standard of surgical treatment of this disease.[6,7] However, even today, some authors consider the open cholecystectomy approach as an indication in some circumstances, as described by Navez[7]: '*Although laparoscopic cholecystectomy is considered a standard treatment for acute cholecystitis, an open approach is still a valid option for more advanced disease'*.

We felt important to statistically analyse our Department's 520 operations, even more so as most of the referred series correspond to multicentric studies,[7,8] including surgeries performed by different surgical centres. Our study has the advantage of representing a homogeneous group of patients, with surgeons working at the same Department and using standardized techniques.

In all the recently published studies, we found a LC *vs.* OC predominance: 93.2% *vs.* 6.8%;[7] 85% *vs.* 15%[9] and 84.4% *vs.* 14.6%,[10] similarly to our Departmental experience.

In comparison with our last published study on this subject,[6] there has been a LC increase (67.1 *vs.* 84.8%; $p < 0.0001$) and an OC decrease (25.7 *vs.* 15.2%; $p = 0.0034$), due to the increasing differentiation of our younger surgeons in minimally-invasive techniques.

The global analysis of our results (Table 6) favours LC *vs.* OC regarding mortality, peri and postoperative complications and hospital stay. CBD lesions were less frequent in LC than in OC (0.9% *vs.* 1.8%) patients, although without any significant value and in line with literature reports (LC *vs.* OC): 0.2 *vs.* 1%;[9] 1.08 *vs.* 2.7%.[7] From the six patients with CBD lesions, three were diagnosed during surgery (two in LC patients and one in OC) and three postoperatively (two LC and one OC patient). From these, in two patients (one LC and one OC patient) the peri-operative cholangiography could not be performed due to severe inflammatory events at the cholecysto-cystic junction; in another LC patient, this lesion occurred during surgery, despite the cholangiography. In addition, there is no unanimity regarding the value of that examination during cholecystectomy. Cholangiography is considered as crucial by some authors,[13] also valued in the peri-operative diagnosis of CBD calculi concomitant to acute cholecystitis;[7] while others authors advocate a more selective use.[14]

We ourselves use it whenever it shows necessary to the definition of the biliary pedicle although the occasional presence of inflammatory changes may prevent its use. It is important to note that the successive technical training of our surgeons in laparoscopic surgery has considerably reduced this complication. The correction of those lesions included four jejunostomies (two LC and two OC patients) and two termino-terminal choledochal anastomoses, all included in the group 2 of Bismuth's classification.

We wish to emphasize that ligation of the cystic duct can be very demanding, even more so in the presence of CBD lesions, explaining complications such as biliary fistulae due to the dehiscence of the cystic duct.. We should also note that the presence of biliary fistulae related to the

presence of biloma is probably dependent on accessory biliary ducts, in line with previous reports.[7]

As regards haemorrhagic complications, they concerned those related to gallbladder dissections from the liver bed and due to iatrogenic splenic lesion, beyond the described lesions to the cystic duct (two OC patients).

We should also mention a 10.3% conversion rate, in line or even below what has been described in literature: 10%[15]; 19.7%[10]; 10.7% and 32% (the latter related to particularly severe patients).[7]

A higher conversion rate in male patients has been described in literature[7] and also in the elderly[14]; we found in our study a higher conversion rate in male patients and in patients aged above 65, although statistically not significant.

We found a higher incidence of surgical complications in the group of converted LC patients when compared to the group of non-converted LC patients: 20.4% *vs.* 6.2% (p = 0.0034). This must be mentioned, in line with was described by Navez[7] and showing that in complex LC procedures, conversion should not be delayed.

The timeframe between surgery and the initial diagnosis (four days was the limit to be considered as an early surgery) was valued in different ways according to different authors. The early LC would obtain a lower conversion rate, according to several studies.[15-17] Others have a different opinion, finding no differences between early and delayed surgery.[10,18,19]

In our study, we found an 8.3% conversion rate in the early and 13.7% in delayed LC (beyond four days). However, the statistical analysis of these values was not significant. The causes for conversion were related to surgical complications (biliary lesions, intestinal lacerations, gallbladder perforations related to gangrenous cholecystitis with abdominal calculi dissemination), intolerance to pneumoperitoneum, undefined biliary pedicle and scoliosis.

The mortality in our study corresponded to seven occurrences: three LC patients (0.7%) and four OC patients, in line with what was described in other studies: 0.4 *vs* 4%;[9] 0.5 *vs.* 5.4%[7]; two patients with CBD lesions due to gangrenous cholecystitis were included in these group.

The hospital stay was lower in LC patients, compared to OC patients, as it would be expected. A percentage of 64.8% of the LC patients had a hospital stay below four days, while 18.5% was the rate in OC patients ($p < 0.0001$).

We should mention the important advantages of LC over the OC in treatment of acute cholecystitis. However, its use must depend on several factors as described in literature, namely the surgeon's experience on this type of surgery and the presence of multi-organic systemic changes.[10,20,21]

CONCLUSION

Our results show the frequency of the laparoscopic approach of the acute cholecystitis in our Department, confirming the increasing importance of the minimally-invasive surgery in the treatment of this disease.

REMARK

Part of this study was presented on the 7th Feb 2014 at the 13th Surgery International Meeting of the *Centro Académico de Medicina* at the Faculty of Medicine of Lisbon University.

CONFLICTS OF INTEREST

The authors declare there were no conflicts of interest in writing this manuscript.

FINANCIAL SOURCES

The authors declare there were no financial supports for writing this manuscript.

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Acta Med Port 2014:27:685-691

Publicado pela **Acta Médica Portuguesa**, a Revista Científica da Ordem dos Médicos

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ISSN:0870-399X | e-ISSN: 1646-0758