

Title: The impact of regional reconfiguration on the management of appendicitis

Authors: DA Healy¹, DP McCartan¹, A Aziz¹, M Clarke Moloney², JC Coffey¹, P Burke¹, SR Walsh¹, PA Grace¹.

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Address for correspondence:

M Clarke Moloney

Vascular Research Unit,

University Hospital Limerick,

Limerick, Ireland.

Email: mary.clarkemoloney@hse.ie

Phone: 061-482736

Affiliations:

1 - Department of Surgery, University Hospital Limerick, Ireland

2- Vascular Research Unit, University Hospital Limerick, Ireland

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Abstract

Background: Reconfiguration of surgical services in the Mid-west in 2009 resulted in a large increase in numbers undergoing emergency surgery for appendicitis in the University Hospital Limerick.

Aims: We aimed to assess the impact of reconfiguration on the management of appendicitis in this area.

Methods: Data on all patients who underwent appendicectomy between January and July 2007 were compared with the corresponding data from January to July 2011. The number of operations, types of operations, LOS, rates of negative histology specimens and readmissions within 30 days were compared.

Results: 125 appendicectomies (48 laparoscopic (38%)) were performed in the 2007 group of which 32 specimens (25.6%) were histologically negative. 319 appendicectomies (238 laparoscopic (75%)) were performed in the 2011 group of which 62 specimens (19.4%) were histologically negative. The increase in numbers of laparoscopic procedures was significant ($p < 0.0001$). The reduction in the negative appendicectomy rate was not statistically significant ($p = 0.15$). There were 10 conversions (20%) to open surgery in the 2007 period and 12 (5%) in the 2011 period ($p = 0.72$). Mean LOS for the 2007 and 2011 groups were 4.45 days and 3.16 days ($p < 0.0001$). 6 (5%) readmissions within 30 days occurred in the 2007 group with 20 (6.3%) in the 2011 group ($p = 0.66$).

Conclusion: While reconfiguration of surgical services has resulted in a significant increase in workload, LOS has decreased significantly while maintaining acceptably low negative appendicectomy, conversion and readmission rates.

Key words: Appendicitis; appendicectomy; reconfiguration; emergency surgery

Introduction

Healthcare services in the Mid-West Area of Ireland are provided by the Mid Western Regional Hospitals Group comprising hospitals across five sites (Limerick [general and maternity], Ennis, Nenagh, St Johns and Croom). Historically, 24-hour emergency services were available independently at University Hospital Limerick (UHL), St John's Hospital, Limerick and at Ennis and Nenagh General Hospitals. Each hospital had an emergency department and intensive care unit with medical and surgical teams on site. In an effort to streamline provision and contain costs, reconfiguration of the hospital services in this area began in 2009. The move toward reconfiguration was fuelled by suggestions of improved patient safety in higher volume centres. While the volume/outcome equation is true for a number of surgical procedures, such as abdominal aortic aneurysm and the management of colorectal cancer (1-3) and for stroke (4, 5), this evidence of improved outcomes with increased numbers is lacking in relation to many other conditions (6, 7). Conversely, overcrowding has been linked with poor outcomes in observational studies (8). Following reconfiguration, which resulted in the centralisation of all emergency surgery to University Hospital Limerick, a dramatic increase in hospital admissions occurred (9).

Aim

With the increase in workload, we wished to determine whether the quality of general surgical services was maintained post reconfiguration and we used appendicectomy, the most common emergency procedure, as an index operation to that end.

We wished to determine the magnitude of the increase in appendicectomy at UHL following reconfiguration. As markers of service quality, we also wished to examine length of stay (LOS), the negative appendicectomy rate, the conversion rate of laparoscopic surgery and the numbers of readmissions and complications within 30 days of surgery.

Methods

Data on all patients who underwent appendicectomy between January and July 2007 were compared with corresponding data relating to the period from January to July 2011. The 2007 database was a subset of a larger prospectively maintained database from a previously published study (10), while the 2011 database was prepared retrospectively from hospital electronic records, theatre logbooks, and medical notes. The numbers of operations, types of operations, lengths of stay (LOS), rates of negative histology specimens and numbers of readmissions were compared. Complications diagnosed within 30 days were also measured. Student's t-test for unpaired data was used to compare means. The Chi-Square test was used to compare categorical variables.

Results

The results are summarised in tables 1, 2, 3 and 4.

One hundred and twenty five (73 males, 52 females) appendicectomies were performed in 2007, while 319 (151 males, 168 females) were performed in 2011. This represents an increase in appendicectomies of 255%. Statistically more males were treated in 2007 (58% vs. 47%, $p=0.04$). Mean ages were similar for the two time periods ($p=0.19$).

Of 125 appendicectomies performed in 2007, forty eight were laparoscopic (38%) while in 2011 this figure was 238/319 (75%) ($p<0.0001$). There were 10 cases (20%) of conversion from laparoscopic to open appendicectomy in 2007 while the corresponding 2011 number was 12 (5%) ($p=0.064$). In 2007, 93/125 of the histological specimens were positive for appendicitis (73%) while in 2011 this figure was 257/319 (81%) ($p=0.15$). Mean LOS for the 2007 group was 4.45 days compared to 3.16 days for the 2011 group ($p<0.001$). Six patients (5%) and 20 patients (6.2%) were readmitted within 30 days in the 2007 and 2011 periods, respectively ($p=0.66$). The reasons for readmissions are summarised in Table 3. Table 4 lists all complications that were identified within 30 days.

Discussion

Reconfiguration of health services in the Mid-West Area has resulted in significant changes in surgical practice. Within a short period, the three satellite hospitals at St John's, Ennis and Nenagh, made a switch to high volume elective surgery while University Hospital Limerick began to manage all of the emergency surgical workload. In relation to appendicitis, we have shown that this workload increase was achieved with very good results. The mean LOS has fallen significantly from 2007 with acceptably low readmission, conversion and negative appendectomy rates.

The proportion of procedures performed laparoscopically has increased significantly. As most appendectomies are performed by trainees under supervision, this increase possibly reflects increasing trainee competence with laparoscopy from dealing with larger numbers of patients. Laparoscopic appendectomy is seen as an excellent training opportunity with evidence demonstrating both its safety and an attainable learning curve (11). The pelvic abscess readmission rate from this study is very low with just 4/444 patients (0.9%) readmitted within 30 days with radiologically confirmed collections. Another noteworthy issue is that of port site herniation. Two cases occurred in the 2011 period of this study - both were managed without bowel resection. Interestingly, both cases occurred at 10mm left iliac fossa port sites. The low rate of this complication mirrors reported rates (13). A final note should be made in relation to wound infections –we feel that low rate of readmission with wound problems reflects good primary care management. It is likely that simple wound infections occurred in greater numbers than reported here.

It is important to acknowledge several limitations and sources of bias in this study. Firstly, the data relating to the 2011 group was collected retrospectively. This is in contrast to the prospectively maintained database relating to the 2007 period. Secondly, we did not measure numbers of diagnostic laparoscopy procedures, instead including only appendectomies. We used readmission and complication rates as quality markers. We acknowledge that minor complications managed in the community will not be detected in this manner, though we feel that major morbidity would be detected.

In conclusion, while workload has increased dramatically, the management of cases of suspected appendicitis has remained satisfactory, with low negative appendicectomy rates and shortened length of stay.

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Table 1: Comparison of patient demographics.

	2007 period n=125	2011 period n=319	p value	Statistical test
Number male	73 (58%)	151 (47%)	p=0.04	Chi square
Number female	52 (42%)	168 (53%)	p=0.04	Chi square
Mean age	26	21	p=0.19	T test

Table 2: Outcomes in numbers and percentages

	2007 n=125	2011 n=319	p value	Statistical test
Number of laparoscopic procedures	48 (38%)	238 (75%)	p<0.0001	Chi square
Number of conversions	10 (20%)	12 (5%)	p=0.086	Chi square
Mean length of stay	4.45 days	3.16 days	p<0.001	t-test
Number of positive histology specimens	93 (74%)	257 (81%)	p=0.15	Chi square
Number of readmissions within 30 days	6 (5%)	20 (6.3%)	p=0.66	Chi square

Table 3: Reasons for readmissions within 30 days

	2007 n=125	2011 n=319
Wound infection	2 (1.6%)	4 (0.9%)
Non specific pain	2 (1.6%)	11 (3.4%)
Respiratory infection	1 (0.8%)	-
Pelvic abscess	1 (0.8%)	3 (0.6%)
Port site herniation with small bowel obstruction	-	2 (n=238 laparoscopic) (0.8%)

Table 4: Complications within 30 days

2007 n=125	2011 n=319
5 wounds infections	1 acute epididymoorchitis
1 post operative ileus	1 post operative ileus
1 post operative acute urinary retention	1 post operative acute urinary retention
1 pelvic abscess	3 pelvic abscesses
	2 lower respiratory tract infections
	3 simple wound infections