

A Single Institute Review of 4,428 Consecutive Appendiceal Resections: Incidence of Suspected and Incidental Pathology

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Abstract

Aims

To determine the incidence of non-appendicitis pathology of the appendix in an Irish context.

Methods

A single institute review of 4,428 consecutive appendiceal resections was conducted independently by two researchers. Clinical, radiological, intra-operative, and histological reports were reviewed.

Results

A total of four-thousand four-hundred and twenty-eight (4,428) appendicectomies including right hemicolectomies, subtotal colectomies, panproctocolectomies, ileocolic resections, and en-bloc resections were performed during the study period. Incidental malignancies occur in less than one per cent (<1%) of appendiceal resections. The mean age of incidental malignancies was 54.75 (range 11 – 79 years), and the mean age for non-incidental appendiceal malignancies was 62 (range 42 – 85 years).

Conclusion

A wide array of neoplastic and inflammatory conditions' incidence in the Irish context is described for the first time.

Introduction

An appendicectomy is one of the most frequently performed operations by general surgeons. Significant incidental pathology can be encountered during this procedure and their peri-operative management. Regional variations in pathological incidence and subtype appear to exist.¹⁻³ Furthermore, recent changes have occurred in the nomenclature of appendiceal malignancies.⁴⁻⁶ Therefore, we aimed to determine the incidence of non-appendicitis pathology of the appendix in an Irish context.

Methods

Ethical approval was granted from the Cork Research Ethics and Audit Committee. A time period where all consecutive appendiceal resection data was available without any interruptions was sought and identified as occurring between 1st of January 2012 and 1st of January 2017. Expansion of the database beyond these dates was limited by supporting technological infrastructure, missing data, and the cyber-attack on the HSE of 2021. Hence, data incorporation was conducted within these dates to prevent any unaccounted records underdiagnosing already rare incidences of pathology, and ensuring only consecutive specimens were included.

A list of records was obtained and amalgamated from the Hospital Inpatient Enquiry system, hand searching theatre logbooks, and review of all lower gastrointestinal multidisciplinary team meeting records in Cork University Hospital for the selected dates. Duplicate patients were removed. The respective histological reports were retrieved from electronic and physical healthcare records and patients included if an appendiceal resection occurred during this time period. Any histological report that did not have an appendix specimen submitted within this time period were excluded. Appendiceal specimens were identified after completion of an open or laparoscopic appendicectomy, or where the specimen was submitted within a larger histological resection.

Demographics including age, sex, and length of stay were ascertained. The operation type in which each specimen was included was recorded, as was the histological diagnosis of each included appendix. En-bloc resections referred to the appendix specimen being submitted as part of a larger colonic resection (panproctocolectomy, subtotal colectomy, right hemicolectomy, ileocolic resection) combined with one or more of the following procedures: gastrectomy, duodenectomy, Whipple's procedure, small bowel resection, Meckel's resection, sigmoid colectomy, anterior resection, nephrectomy, hysterectomy, adnexal / salpingo-oophorectomy, cystoprosatotomy, and an abdominal wall sarcoma resection.

Each case of appendiceal neoplasm was examined to determine rates of incidental diagnosis, management and outcomes. An incidental finding was defined as that which the clinical presentation, pre-operative imaging (if performed), or intra-operative findings had not determined the diagnosis prior to the finalised histological report.

Results

A total of 3,801 appendicectomies, 346 right hemicolectomies, 143 subtotal colectomies, 40 panproctocolectomies, 47 ileocolic resections, and 51 en-bloc resections were performed during the study period.

Non-malignant non-appendicitis pathological results were observed in 63 per 1000 appendicectomies. Acute appendicitis was the most frequently recorded histological result. A negative appendicectomy rate of 17% was observed.

A 1 : 0.23 and 1 : 0.8 incidental and non-incidental male to female ratio was observed. The mean age of incidental malignancies was 54.75 (range 11 – 79 years), and the mean age for non-incidental appendiceal malignancies was 62 (range 42 – 85 years). The rate of incidental malignancy per 1,000 appendicectomies of all ages was 3.6 cases for a neuroendocrine tumour, 1.2 cases for a mucinous adenocarcinoma (+/- signet ring), and 1.6 cases for a goblet cell carcinoma. Analysis of appendicectomy resections in patients aged greater than 16 years, revealed these rates increased to 4, 1.75, and 2.34 respectively. Of the incidental appendiceal malignancies that presented acutely who underwent an appendicectomy, all had symptoms suggestive of appendicitis. For all other incidental appendiceal malignancies submitted as part of a larger resection, intra-operative findings noted a macroscopically normal appendix. Pre-operative imaging (where conducted) reported features suggestive of complicated appendicitis in the appendicectomy cohort who subsequently were diagnosed with an incidental appendiceal neoplasm.

All pathological results are shown in Table 1. When analysing the national incidence of appendiceal malignancy during the corresponding time period, our findings represent 11% (n=24/222) of neuroendocrine tumours, 15% (n=9/61) of mucinous adenocarcinomas, 20% (n=6/30) of non-mucinous adenocarcinomas, and 10% (n=4/42) of goblet cell carcinomas.

Discussion

We outline the incidence of incidental appendiceal pathology in an Irish context. Considerable variation exists within and between geographic regions and nations.¹ Understanding the incidence of occurrence allows for planning of resources and forecasting required investments necessitated by changing demographic profiles.

Management of patients with incidental pathology is best derived by multidisciplinary team meetings and tailored to patients as per best practice guidelines. Incidental rates of appendiceal cancer are of clinical significance and should not be forgotten in the patient presenting with acute appendicitis.

	Appendectomy	Right Hemi-colectomy	Subtotal Colectomy	Pan-proctocolectomy	Ileocolic Resection	En-bloc Resection
Number of Operations	3,801	346	143	40	47	51
Age	Mean (Years)	24	64	51	51	46
	+/- SD	+/- 15	+/- 17	+/- 20	+/- 17	+/- 24
Sex	(Male:Female)	1 : 0.98	1 : 0.7	1 : 0.68	1 : 0.54	1 : 1.35
Length of Stay	Days	3	17	20	21	19
	Range	196	130	107	89	350
<u>PATHOLOGY</u>						
Pseudomyxoma peritonei						
Low grade mucinous carcinoma peritonei	3	0	0	0	0	3
Acellular mucin	2	0	0	0	0	0
Mucinous epithelial neoplasms						
Mucinous adenocarcinoma	7	2	0	0	0	0
Mucinous signet ring carcinoma	1	0	0	0	0	0
HAMN	2	0	0	0	0	0
LAMN	15	3	1	1	0	2
Non-mucinous epithelial neoplasms						
Non-mucinous adenocarcinoma	2	4	0	0	0	0
Epithelial neoplasms with neuro-endocrine features						
Neuroendocrine tumour - carcinoid	18	4	1	0	1	0
Goblet cell carcinoma (carcinoid)	2	2	0	0	0	0
Mesenchymal tumours						
CLL	1	0	0	0	0	0
Multilocular cystic lymphangioma	0	0	0	0	0	1
Neuroma / neural hyperplasia	2	2	0	0	0	0
Heterotopic bone	1	0	0	0	0	0
Mesothelial cyst	0	2	1	0	0	0
Mucoceles						
Mucinous cystadenoma	10	3	0	1	1	1
Mucin extravasation	1	0	0	0	1	0
Malignant invasion / metastasis						
Colonic adenocarcinoma	0	6	0	0	0	1
Ovarian adenocarcinoma	1	0	0	0	0	2
Enteric neuroendocrine tumour	0	0	0	0	1	0
Mucosal lesions / polyps						
Tubular adenoma	5	2	0	0	0	0
Villous adenoma	0	2	0	0	0	1
Traditional serrated adenoma	5	4	2	0	1	1
Sessile serrated lesion	4	1	0	0	0	0
Hyperplastic	5	2	3	0	0	1
Mucosal hyperplasia	3	6	0	0	0	0
Inflammatory conditions						
Chronic appendicitis	24	2	2	1	3	3
Appendiceal diverticulitis	4	2	0	0	0	0
Entero-appendiceal fistula	0	1	0	0	1	0
Lymphoid hyperplasia	13	6	1	0	0	0
Inflammatory bowel disease (UC/Crohn's)	8	8	19	10	4	2
Tuberculosis	1	0	0	0	0	0
Gynaecological conditions						
Endometriosis of the appendix	10	1	0	1	1	1
Mullerian cyst of the appendix	3	0	0	0	0	0
Ischaemic conditions						
Appendiceal ischaemia	0	2	1	0	1	0
Appendiceal epiploic appendagitis	2	3	0	0	0	0
Infective conditions (Other)						
Tuberculosis	1	0	0	0	0	0
Enterobius vermicularis	111	0	0	0	0	0

Table 1. Demographics and pathological incidence in each cohort of appendiceal resection.

HAMN = high grade appendiceal mucinous neoplasm, LAMN = low grade appendiceal mucinous neoplasm, CLL = chronic lymphocytic leukaemia. Chronic appendicitis is inclusive of reports (n=5) which record foamy histiocytic cells of the appendix or granulomas otherwise not accounted for by a diagnosis of inflammatory bowel disease or mycobacterial infection.

Declarations of Conflicts of Interest:

None declared.

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