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Original research

A descriptive cost analysis study of cases of right iliac fossa pain

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ABSTRACT

Patients with suspected appendicitis comprise a large proportion of general surgical workload. The resulting healthcare burden is significant when one considers that investigations, observation and surgical procedures are often needed. As no previous study has examined the cost of managing patients with suspected appendicitis, we performed a cost analysis study of management of cases of right iliac fossa (RIF) pain in University Hospital Limerick.

Patients who were admitted with right iliac fossa pain from 1st April 2011 to 4th May 2011 were identified prospectively. After discharge, patients' medical records were reviewed. Costing data collected comprised details on length of stay, number and type of radiological investigations, number and type of blood investigations, medications administered and operations performed. Costs for radiological investigations were obtained from casemix data. Blood investigation costs were obtained from relevant laboratories. Medication costs were obtained from the pharmacy department. Operation costs were based on the cost of equipment combined with cost relating to operating theatre time and recovery unit time. Due to unavailability of data on Irish public hospital bed-day cost, a private hospital provided cost details on this aspect.

94 patients (M = 33, F = 61) were admitted with RIF pain during this time period. 62 underwent surgery. There were 53 appendicectomies performed with 42 (79%) positive for appendicitis on histological analysis. Blood test, radiology, pharmacy, operative and bed-day costs were €1857, €6252, €3517, €184,191 and €152,706 respectively. The total estimated cost was €348,525 (€3708 average per patient).

There is a high cost associated with managing suspected appendicitis in Ireland. Strategies to reduce cost include reducing unnecessary admissions and unnecessary operations. Reducing LOS may be another potentially valuable cost saving method. It is imperative that resources are channelled into the provision of accurate costing structures.

1. Introduction

Appendicitis is one of the most common surgical emergencies.[1] Patients with right iliac fossa (RIF) pain and suspected appendicitis are one of the most common groups of general surgical admissions. These patients frequently require admission although initial diagnoses are often uncertain. The health system burden attributable to these patients is significant, when one considers that investigations and a period of observation are frequently needed, with a surgical procedure following in certain cases. While several previous studies,[2–15] including a Cochrane review,[16] have examined the cost of managing patients with appendicitis, there has been no previous study on the cost of managing patients who are admitted with suspected appendicitis.

Determining the cost of managing these patients is important in order to guide future resource allocation and research directions. Knowing the cost becomes important also when we consider that many patients with suspected appendicitis subsequently are found to have benign and self-limiting disease that would not have necessitated admission if a clear diagnosis had been known. Theoretical ways to reduce cost include achieving early diagnosis with subsequent prompt discharge for those without serious disease and urgent surgical intervention for those with serious disease. With the budgetary problems of managing suspected appendicitis in mind, we performed a prospective cost analysis study of management of cases of RIF pain in the setting of a tertiary referral teaching hospital in Ireland.

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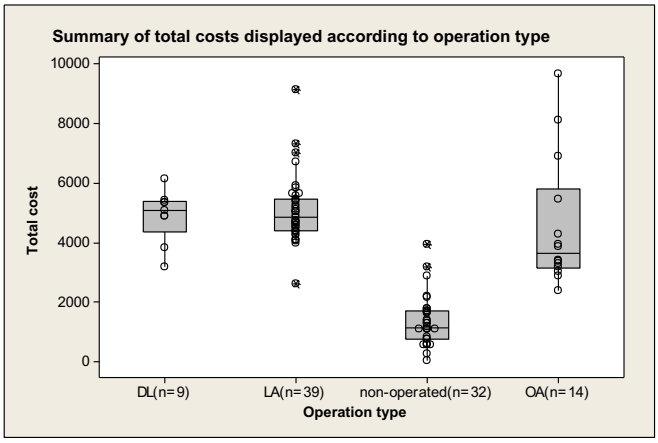
Table 1
Summary of total costs displayed in five components.

Cost component	Total cost
Blood tests	€1857
Radiology	€6252
Medications	€3517
Operative costs	€184,191
Hospital stay	€152,707
Total cost	€348,525
Average cost	€3708



DL–diagnostic laparoscopy; LA – laparoscopic appendicectomy; OA – open appendicectomy.

Fig. 1. Boxplot of costs (in euro) displayed according to operation type, including patients who had no operation.

2. Aim

The primary objective was to determine the cost of managing consecutive patients who were admitted to University Hospital Limerick (UHL) with RIF pain over a 5 week period from April 2011 to May 2011. Our secondary aim was to examine relationships between cost and gender, age, operation type (non-operated, diagnostic laparoscopy, laparoscopic appendicectomy or open appendicectomy) and appendicitis severity (based on histology reports of normal, inflamed or perforated specimens).

3. Methods

All patients who were admitted under the on-call surgical team with RIF pain from 1st April to 4th May 2011 were eligible for inclusion. There were no exclusion criteria. RIF pain was defined as abdominal pain with RIF tenderness on assessment by the admitting surgical team member. Eligible patients were identified prospectively by liaising with the on-call surgical team on a daily basis. All decisions regarding management were made by the on-call team. If it was decided that a patient needed surgery, the on-call team of that day performed the surgery and managed the patient post-operatively.

After discharge, patients' medical notes were reviewed. Computerised laboratory and radiology databases were also interrogated and data were entered into an electronic spreadsheet. Data were obtained on number and type of blood and radiological investigations, amount of medications used, length of hospital stay (LOS) and whether or not surgery was performed. If surgery was performed, the type and length of procedure was documented. The costs of these components of care were obtained where possible from relevant departments. Histology results were obtained and used to determine definitive diagnoses.

The haematology, biochemistry and serology laboratories provided figures for the cost of blood tests. The cost figures for the haematology and biochemistry tests were solely the reagent costs and did not account for staffing, building and other running costs (an accurate costing structure which accounts for all fixed and variable costs in these departments was not available). The figure for the cost of a C-reactive protein (CRP) assay included both fixed and variable costs. The casemix department provided information on the cost of radiological investigations which are specific to University Hospital Limerick radiology department. They are calculated on an annual basis by trained Irish healthcare service casemix staff and include all costs relating to radiological investigations divided by the number of investigations per year (capital costs and depreciation are not included). For ultrasound (USS) and computed tomography (CT) examinations, we additionally incorporated reporting fees based on figures obtained from an Irish health insurance company (VHI). Using this method, costs were as follows: plain radiographs – €64; USS examinations – €177; CT examinations – €303. The pharmacy department provided details on the cost of medications. Individual drug costs were not available due to a confidentiality agreement between the hospital pharmacy and suppliers. However, the pharmacy provided a cumulative figure for the overall cost to the hospital for the drugs used. This figure did not include costs related to staffing and pharmacy departmental running costs. For simplicity, medication costs were divided into three categories (analgesic medications, anaesthetic medications and general medications), thereby allowing a degree of individualisation of costs. Operation costs were derived by adding the costs of the equipment, operating theatre time cost and post anaesthesia care unit (PACU) cost. We used 2010 operating theatre time cost of $30 per minute[17] as a measure of operative time cost. This per minute rate was converted to a corresponding 2011 value via Consumer Price Index (CPI) conversion[18] and subsequently to Euro based on an average 2011 conversion rate of €0.7190 per US dollar.[19] This resulted in an operating theatre per minute cost of €22.29. We assumed that patients spend 30 min in the PACU, corresponding to €58.56. This is based on published PACU costing data[20] with CPI and Euro conversions. Regarding length of stay costs, the casemix department provided a nationwide average figure of €1356 per hospital bed-day for Ireland, which reflects the total overall average cost of medical care per day in Ireland and so is not relevant to this study. As a substitute, we searched for costing details from the private sector. Mount Carmel Hospital (a private hospital in Dublin) quoted a semi-private bed day cost of €533.94 and a private bed-day cost of €678.43, which reflects solely length of stay. For the current study, we used the semi-private figure as the bed-day cost, accepting that this is prone to some inaccuracy.

Statistical analyses were performed with Minitab version 16. Descriptive statistics and boxplots were used to summarise costs. Students *t* test and one way analysis of variance (ANOVA) (with Tukey multiple comparison testing) were used to examine differences in mean costs. For all tests, significance was set at 0.05.

4. Results

94 patients (M = 33, F = 61) were admitted with RIF pain during this time period. 71 patients were under 30 years of age. 62 patients underwent surgery of whom 14 patients underwent open appendicectomy, 39 underwent laparoscopic appendicectomy (with 3 open conversions) and nine underwent diagnostic laparoscopy.

Table 2
Summary cost data (in euro) when patients are divided into groups based on operation type – open/laparoscopic appendicectomy, diagnostic laparoscopy and non – operated. 95% confidence intervals were calculated using one-way ANOVA testing. $p < 0.001$ ANOVA.

	n	mean	SD	Individual 95% CIs For Mean Based on pooled standard deviations
DL	9	4900	891	(------*------)
LA	39	5067	1093	(--*--)
none	32	1350	837	(--*---)
OA	14	4542	2181	(-----*----)
				1200 2400 3600 4800

ANOVA – analysis of variance; CI – confidence intervals; DL – diagnostic laparoscopy; LA – laparoscopic appendicectomy; none – no operation; OA – open appendicectomy; SD – standard deviation.