Negative Appendicectomy Rates and Implication of Preoperative Imaging: A Retrospective Cohort Study

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Introduction

Appendicitis was the cause of 40,588 emergency admissions with 33,193 emergency appendicectomies performed in England from April 2012 to March 2013 [1]. There is presently no standard definition of a negative appendicectomy (NA) as it can refer to a macroscopically or histopathologically normal appendix [2,3]. Recent studies from the United Kingdom show NARs that range from 19% to 33.9% [4-9]. Internationally, a NAR of 15.3% was reported in 261,134 patients from the United States in 2002 [10]. Brockman et al. summarized 11 recent international large studies to generate a combined NAR of 26% [11]. There is also considerable argument about the management of the normal appendix. The Royal College of Surgeons in Ireland in 2005 issued a Grade B recommendation that a macroscopically normal appendix may be left in situ. However, counterarguments in favor of removing the normal appendix are that it can hide microscopic appendicitis or other pathology and that removal does not lead to increased morbidity or complications.

Methods

100 consecutive patients who underwent both open and laparoscopic emergency appendicectomy in our district general hospital from June 2019 till November 2019.

Results

The negative appendicectomy rate was 22%. With pre-operative CT scan, it came down to 11.5%. If all patients undergo pre-operative CT, with a reduction of 10.5% in negative appendicectomy rate, the overall total cost reduction would be £23,700. Preoperative consultant review did not reduce NAR rather increased.

Conclusion

Finally, our study revealed that the negative appendicectomy rate could be improved by preoperative imaging. Further studies should focus on a consistent CT protocols to reduce the risk of radiation, especially in young adult and females.
Negative appendicectomy was defined as a pathologically normal appendix removed from patients suspected with appendicitis.

**Results**

100 patients were included in this retrospective study (Figure 1). Average age of patients undergoing appendicectomy 33 years. Male patients were 47 and Female patients were 53. Female to male ratios 53:47. Number of patients not seen by consultants 37. The negative appendicectomy rate was 22% (Table 1). With pre-operative CT scan, it came down to 11.5%. One patient had preoperative MRI due to pregnancy (Table 2). Based on the 2018/19 national tariff payment scheme, a CT abdomen and pelvis with contrast and emergency appendicectomy cost 92 and £2370, respectively. The total cost of patients who underwent appendicectomy without imaging was £2,37,000. If all patients undergo pre-operative CT, with a reduction of 10.5% in negative appendicectomy rate, the overall total cost reduction would be £23,700. Preoperative consultant review did not reduce NAR rather increased. Obviously, most of these patients were the patients who underwent diagnostic laparoscopy and the macroscopically normal appendix was removed after no other cause was found. Even though not all patients had sufficient data to calculate Alvarado score, it was not found significant in reduction of NAR (Table 3).

![Histopathological findings for all the patients.](image)

**Table 1:** Effect of preoperative consultant review.

| Preop Consultant review                  | Acute appendicitis | Normal appendix | Total patient | NAR |
|-----------------------------------------|--------------------|-----------------|---------------|-----|
| Patient reviewed by consultants         | 47                 | 16              | 63            | 25% |
| Patient not reviewed by consultants     | 31                 | 6               | 37            | 16% |

**Table 2:** Effect of preoperative imaging:

| Imaging                               | Acute appendicitis | Normal appendix | NAR   |
|---------------------------------------|--------------------|-----------------|-------|
| CT scan showed Acute appendicitis     | 23                 | 3               | 11.50%|
| CT scan showed normal appendicitis    | 1                  | 0               |       |
| MRI due to Pregnancy                  | 1                  | 0               |       |

**Table 3:** Significance of Alvarado scoring.

| Alvarado score | Acute appendicitis | Normal appendix | NAR |
|----------------|--------------------|-----------------|-----|
| >7/8           | 7                  | 2               | 22% |
| <7             | 2                  | 1               | 33% |
Conclusion

Finally, our study revealed that the negative appendicectomy rate could be improved by preoperative imaging. This study also showed that implementation of preoperative imaging for suspected appendicitis cases would be cost saving, allowing better distribution of resources. Further studies should focus on a consistent CT protocol to reduce the risk of radiation, especially in young adult and females.

Disclosure, Ethics and Funding

No conflicts of interest to disclose. This study was registered with relevant department of the hospital. Data were collected retrospectively, and no patients’ identifiable numbers were used. No funding was involved.

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